

S47-2

-15-

DETAIL REQUIREMENTS

ALL CLASSES

S47-2-w. Casings.

1. The casings shall be divided into two parts so as to permit ready removal of the rotors and for bearing and gland replacement.
2. The design of casings shall be sufficiently rugged to withstand without fracture or appreciable distortion the strains to which they may be subjected.
3. Sufficient clearance shall be provided around bolt heads and nuts to permit the use of ordinary tools.
4. Fitted bolts or heavy dowel pins shall be provided to insure maintenance of alignment of casing halves in reassembly.
5. Forcing bolts shall be provided for breaking joints.
6. All pumps shall be fitted with drain connections and valves.
7. All pumps shall be fitted with vent connections and valves on the discharge casings of each stage.

S47-2-x. Suction and discharge connections.

1. Suction and discharge connections shall be flanged.
2. Suction and discharge connections shall in general be located on the bottom or fixed half of casings. Where connections on the removable half of casings are approved in special cases, adjacent sections of piping shall be short and readily removable so as to permit disassembly of pump with a minimum disturbance of piping.
3. The size of suction and discharge connections shall be as required by applicable Bureau of Engineering Standard Sheets, B-114, B-115, and B-116 or as approved.

S47-2-y. Impellers and shafts.

1. Outside surfaces of impellers shall be smooth finished, inside surfaces shall be file finished in so far as practical.
2. Impellers shall be keyed on the shaft and securely held against lateral movement by locked nuts or other approved means.
3. Impellers shall be fitted with removable wearing rings except as otherwise specified under detail requirements of the individual class of pump.

S47-2

-16-

4. All shaft threading shall be counter to the direction of rotation except where right hand and left hand units are installed in which case, in order to reduce the number of spare shafts required, the threading shall be right hand for all units and the threaded parts shall be locked in place in a manner satisfactory to the Bureau.

5. All shafts one inch in diameter and larger shall be fitted with shaft sleeves in way of stuffing boxes, diaphragm bushings and water lubricated bearings.

6. Shaft flingers shall be provided for all pumps adjacent to stuffing boxes.

7. The shaft of all pumps except those driven by alternating current motors, shall be provided with means to permit the ready and direct use of a portable tachometer.

8. All rotors shall be dynamically balanced with all rotating parts connected thereto; for common shaft assemblies or those using a rigid coupling this requires dynamic balance with the rotating elements of the driving unit in place. This dynamic balance shall be carefully made, shall be practically perfect, and such as to insure that no appreciable vibration will be developed at any speed of rotation up to 25 percent in excess of the maximum operating speed.

S47-2-a. Stuffing boxes and packing.

1. Stuffing boxes shall be of adequate depth and design to reduce leakage to a minimum under all operating conditions.

2. Packing shall be in accordance with Bureau of Engineering standard sheet B-153. All packing shall be of an approved brand.

3. All stuffing boxes shall be fitted with composition throat bushings.

4. The stuffing boxes of all pumps subjected to suction pressure which under any condition of operation may be below atmospheric pressure shall be fitted with water seal connections and lantern rings located between inner and outer sets of packing. Special care shall be taken in the design to insure that compression of the inner packing will not allow the lantern ring to move sufficiently to cut off or restrict the sealing water supply. In special designs where a water lubricated bearing is approved, consideration will be given to the use of a combination lantern ring, throat bushing and bearing, in which case the inner rings of packing may be omitted. Sealing water connections shall be as specified under detail requirements of the individual class of pump.

-17-

347-2

5. The design shall be such as to insure that leakage from the glands cannot reach the bearings or be thrown over bearing housings or driving units. This shall preferably be accomplished by using glands cored out internally and provided with a shaft flinger. Aisle drip pockets, spray shields and drains shall be provided. For requirements regarding drain collecting systems see Subsection 348-2.

6. Gland and lantern rings shall be split in halves with the halves secured together in an approved manner to form a solid ring for setting up. If aisle space is provided to remove packing and repack glands lantern rings and glands need not be split.

7. All stuffing box glands shall be set up by nuts threaded on gland wing bolts or studs secured in the casing.

8. Sufficient space shall be provided between bearings and stuffing boxes to permit easy renewal of packing and inspection and overhaul of bearings.

347-2-aa. Couplings.

1. For horizontal or vertical 4 bearing units an all metal flexible coupling of a type guaranteed by the contractor and of a design satisfactory to the Bureau shall be installed between the pump and its driving unit.

2. For horizontal 3 bearing units the pump and driving unit shaft shall be continuous or fitted with a rigid coupling between pump and driving unit as specified or approved.

3. Vertical 3 bearing units will be approved only when space considerations are such that a 4 bearing unit cannot be installed. When approved, the unit shall be fitted with a rigid coupling between pump and driving unit.

4. All flexible coupling hubs shall be keyed to the shaft and secured by lock nuts. For shafts one-inch in diameter and larger the hubs shall be fitted on a taper with keys parallel to the taper.

5. All rigid couplings shall have fitted bolts and the coupling flanges shall be marked at assembly to insure proper reassembly after overhaul of the unit.

347-2-bb. Fittings.

1. The bottom of all pump casings shall be fitted with suitable connections and valves to permit complete draining of the pump.

2. The bottom of all drip pockets shall be pipe tapped for drain connections.

3. All drain connections shall be led to the proper drain collecting system as specified in Subsection 348-2.

347-2

-18-

4. The tops of all pump casings shall be fitted with vent connections.

5. Class A, D, and E pumps are required to be fitted with suction casing vent connections to prevent vapor binding and to permit removal of air entrained with the liquid handled.

Class A Pumps

347-2-cc. Performance characteristics.

1. The total capacity of all main feed pumps installed on a particular vessel shall be that necessary to supply the amount of feed water needed for full power operation of the vessel plus 50 percent plus a 5 percent allowance for recirculation from the pump discharge to the feed tank.

2. The rated capacity of cruising feed pumps, if installed shall be as specified and shall be in addition to the above.

3. The head capacity curve of feed pumps shall rise continuously from rated capacity to shut-off so that at constant rated speed the shut-off pressure shall be not less than 15 percent greater than at rated capacity.

4. At constant rated speed the pumps shall develop 120 percent rated capacity at a pressure not less than 80 percent of rated discharge pressure.

5. All pumps in this class for use with open feed tank systems shall, unless otherwise specified or approved, develop rated capacity and pressure at rated speed when operating under a suction head of 2 feet and at a temperature of 160° F. Pumps for use in connection with closed feed systems shall develop rated capacity and pressure at rated speed when operating under a suction head of 25 pounds per square inch gage and at a temperature of 250° F.

6. All class A main and cruising feed pumps discharging into the same feed main shall operate satisfactorily in parallel without surging under all conditions of operation from shut-off to full capacity when operating under any of the following methods of control of the driving unit:

(a) Unit operating at constant speed under control of speed limiting governor.

(b) Unit operating at variable speed under manual control of hand throttle.

(c) Unit operating at variable speed under control of constant pressure pump governor.

-19-

947-2

7. The rotative speed of class A pumps shall not exceed that indicated by Bureau of Engineering Standard sheet B-170, for a given capacity, suction pressure and temperature.

947-2-4d. Materials.

1. Materials for class A pumps shall conform to the following:

- (a) Casings, class B cast steel (N.D. Spec. 4931) for pressures exceeding 600 pounds per square inch gage; class B cast steel or gun metal (N.D. Spec. 46M6) for pressures 600 pounds per square inch gage and below.
- (b) Casing bolts, alloy #2 forged steel (N.D. Spec. 4932) or steel (N. D. Spec. 43B14).
- (c) Diaphragm (interstage pieces), class B cast steel (N. D. Spec. 4931) or gun metal (N. D. Spec. 46M6).
- (d) Diaphragm bushings, bearing bronze, grade 1 (N. D. Spec. 46B22) nitrided steel (N. D. Spec. 46B30), class B forged steel (N. D. Spec. 4932) surfaced with cobalt-chromium alloy (N. D. Spec. 46R5).
- (e) Diffusers, gun metal (N. D. Spec. 46M6), manganese bronze (N. D. Spec. 46B3), nickel-copper alloy, cast (N. D. Spec. 46M1).
- (f) Impellers, nickel-copper alloy, cast (N. D. Spec. 46M1).
- (g) Impeller wearing rings, nickel-copper alloy, (N.D. Specs. 46M1 or 46M7), corrosion resisting steel, grade 5 (N. D. Spec. 46B18), gun metal (N. D. Spec. 46M6).
- (h) Casing wearing rings, nickel-copper alloy (N. D. Specs. 46M1 or 46M7), phosphor bronze grade 1 (N. D. Spec. 46B5), Journal bronze (N. D. Spec. 46B9), or gun metal (N. D. Spec. 46M6).
- (i) Shafts, class A or alloy #3 forged steel (N. D. Spec. 4932), or nickel-copper-aluminum alloy (N. D. Spec. 46N5).
- (j) Shaft sleeves, nickel-copper-aluminum alloy (N. D. Spec. 46N5) minimum hardness 265 Brinell.
- (k) Pressure breakdown drums and bushings, gun metal (N. D. Spec. 46M6), manganese bronze (N. D. Spec. 46B3), class B forged steel (N. D. Spec. 4932) surfaced with cobalt chromium alloy (N. D. Spec. 46R5), or nickel-copper-aluminum alloy (N. D. Spec. 46N5) minimum hardness 265 Brinell.

347-2

-20-

(f) Bearing brackets and caps, class B cast steel (N. D. Spec. 4831), or gun metal (N. D. Spec. 46N6).

(g) Bearing shells, cast steel or gun metal (N. D. Spec. 46N6) lined with anti-friction metal grade 2 (N. D. Spec. 46M2).

(h) Lantern rings and glands, gun metal (N. D. Spec. 46N6), or phosphor bronze grade 1 (N. D. Spec. 46B5).

2. Impeller and casing wearing rings shall be of dissimilar metals.

3. Pressure break-down drums and bushings shall be of dissimilar metals.

347-2-cc. Design and construction.

1. Class A pumps shall be hydraulically balanced.

2. Boiler feed pumps shall preferably be of 4 bearing construction with a flexible coupling between pump and driving unit. Special designs of 3 bearing units will be considered for specific approval where space limitations are such that a 4 bearing unit cannot be installed.

3. Pumps in this class shall be fitted with pivoted segmental type bearings designed to take thrust in either direction.

4. The first critical speed shall be at least 25 percent above the maximum operating speed of the unit. Critical speeds shall be stated on pump assembly plans.

5. Where diaphragms are fitted between stages they shall be sealed around shaft sleeves by labyrinth type packing.

6. Casing wearing rings shall be fitted to all pumps. Impeller wearing rings shall be fitted to all pumps except where casing rings are of labyrinth construction. Impeller wearing rings shall preferably be secured to the impeller by threading with threads counter to the direction of rotation.

7. The radial clearance between impeller and casing wearing rings shall be not less than indicated in the following table; all clearances to be measured on radius, i.e., the difference in diameters between impeller and casing wearing rings shall be not less than twice the clearance given below.

<u>Rated pump capacity</u> <u>G.P.M.</u>	<u>Clearance</u> <u>Inches</u>
249 and below	0.006
250 to 499	0.0075
500 and above	0.009

-21-

347-2

8. Pump casing joints may be made up either metal to metal or by use of one of the following gasket materials:

Soft annealed copper
Soft annealed iron
Compressed asbestos sheet 1/64-inch thick

9. The design shall be such that pressure on the stuffing boxes will not exceed pump suction pressure by more than 50 pounds per square inch. In order to accomplish this pressure breakdown drums and/or labyrinth packing shall be fitted inside pump stuffing boxes and a leakoff connection shall be taken between pressure breakdown device and the inside turn of packing. This leakoff connection shall be led to the suction nozzle of the pump and in such a manner as to avoid disturbance in the flow of water.

10. Each class A pump shall be fitted with a recirculating connection on the volute of the last stage or on the discharge nozzle. This connection shall lead directly to the feed tank. The line shall be fitted with a suitable stop valve and restricting orifice designed to pass approximately 5 percent of the rated capacity of the pump. Individual recirculating lines from each pump may be combined into a common line. A stop valve with means for normally locking them in the open position shall be fitted in the recirculating line adjacent to the feed tank.

11. All class A pumps shall be fitted with suction vent connections. These connections shall be fitted with suitable stop valves and shall be piped through a continuously rising line to the top of feed tank or to vent condenser.

12. Casing vent connections shall be fitted with suitable valves and led through sight flow fittings to drain collecting systems as specified in Subsection 348-2, or to bilge in a manner to afford protection to personnel, as specified or as approved.

13. The following connections on feed pump casings shall be flanged:

Discharge pressure gage line
Pump governor actuating line
Casing vents
Casing drains
Suction vents
Pressure breakdown leakoff and its connection to suction nozzle

The use of steel welded flanged nipples will be acceptable where connection to flanges cast integral with casing is not practical due to interferences with lagging or adjacent parts.

S47-2

-22-

14. All boiler feed pumps shall be provided with relief valves on the discharge side, installed on a fitting between pump and discharge stop valve. The relief valves shall discharge to the bilges and in such a manner as to afford protection to personnel. The size of relief valves shall be not less than one-half the diameter of the discharge line.

15. Feed pumps, designed to operate in parallel, shall be provided with check valves installed in the discharge line from each pump and fitted with an indicator in order to show the amount of valve opening.

Class B Pumps

S47-2-ff. Performance characteristics.

1. All main circulating pumps shall be capable of pumping bilges at a rate not less than 25 percent of the rated capacity with a dynamic suction lift of 15 feet of water.

S47-2-gg. Materials.

1. Materials for class B Pumps shall conform to the following:-

- (a) Casings, gun metal (N. D. Spec. 46M6).
- (b) Casing bolts, nickel-copper alloy rolled, class a or b (N. D. Spec. 46M7), manganese bronze, rolled (N. D. Spec. 46B13) or Naval Brass, rolled (N. D. Spec. 46B6).
- (c) Propellers or impellers, nickel-copper alloy, cast (N. D. Spec. 46M1).
- (d) Guide vanes, gun metal (N. D. Spec. 45M5) or manganese bronze, cast (N. D. Spec. 49B3).
- (e) Shafts, nickel-copper-aluminum alloy (N. D. Spec. 46N5) minimum hardness 265 Brinell.
- (f) Shaft sleeves, nickel-copper-aluminum alloy (N. D. Spec. 46N5) minimum hardness 265 Brinell.
- (g) Internal water lubricated bearings laminated phenolic material grade PM (N. D. Spec. 17P5), bearing bronze, grade 2 (N. D. Spec. 46B22), or high lead content bronze of characteristics satisfactory to the Bureau.

547-2

-23-

547-2-bb. Design and construction.

1. All main circulating pumps shall be provided with a bilge suction connection one-half the diameter of the pump inlet. This connection shall be provided on a fitting adjacent to pump inlet unless otherwise specified.

2. The pump casing shall be split to facilitate the ready removal and replacement of pump shaft, internal pump bearings, and impellers.

3. Pump casing joints shall be made up using a 1/16-inch gasket of one of the following materials:

- (a) Rubber sheet cloth insertion, N.D. Spec. 33P8.
- (b) Rubber sheet wire insertion, N.D. Spec. 33P10, or
- (c) Compressed asbestos sheet, N.D. Spec. 33P13.

4. Class B pumps direct connected to driving turbine shall be fitted with two radial bearings, one located in the pump and one outboard or above the turbine.

5. Class B pumps driven through a reduction gear shall be provided with three radial bearings, one on each side of gear wheel and one in the pump.

6. Radial bearings shall be of the sleeve type. The design of internal water lubricated bearings shall be subject to the specific approval of the Bureau.

Class C-1 and C-2 Pumps

547-2-11. Performance characteristics.

1. Class C-1 pumps intended for parallel operation shall have a constantly rising head-capacity characteristic curve such that total head at shut-off is not less than 10 percent above total head at rated capacity.

2. Class C-2 pumps shall have a constantly rising head-capacity characteristic curve such that when operating on flushing service at constant rated speed the total head at shut-off will be not less than 10 percent nor more than 30 percent above total head at rated capacity.

547-2-11. Materials.

1. Materials for class C-1 and C-2 pumps shall conform to the following:

- (a) Casings, gun metal (N. D. Spec. 46M6).
- (b) Casing bolts, salt water service, nickel-copper alloy rolled, class a or b (N. D. Spec. 46M7), Naval brass (N. D. Spec. 46B6), or manganese bronze (N. D. Spec. 46B15); fresh water service, steel (N. D. Spec. 43B1).

547-2

-24-

(c) Impellers, nickel-copper alloy cast (N. D. Spec. 46M1), for pumps having a total head of less than 100 feet per stage impellers may be of gun metal (N. D. Spec. 46M6).

(d) Impeller and casing wearing rings: nickel-copper alloy (N. D. Specs. 46M1 or 46M7), gun metal (N. D. Spec. 46M6), phosphor bronze, grade I (N. D. Spec. 46B5), or journal bronze (N. D. Spec. 46B9). A wearing ring and its opposing surface shall be of dissimilar metals.

(e) Shafts fitted with shaft sleeves:

(1) Salt water service, nickel-copper-aluminum alloy (N. D. Spec. 46N5), or nickel-copper alloy rolled, class a (N. D. Spec. 46N7).

(2) Fresh water service, Class A or class B forged steel (N. D. Spec. 46B2), nickel-copper alloy rolled, class a (N. D. Spec. 46M7), or nickel-copper-aluminum alloy (N. D. Spec. 46N5).

(f) Shaft sleeves, nickel-copper-aluminum alloy (N. D. Spec. 46N5) minimum hardness 265 Brinell.

(g) Shafts without sleeves, fresh or salt water services, nickel-copper-aluminum alloy (N. D. Spec. 46N5) minimum hardness 265 Brinell.

(h) Bearing brackets and caps, gun metal (N. D. Spec. 46M6), or class B cast steel (N. D. 49B1).

(i) Bearing shells for oil lubricated sleeve bearings, cast steel or gun metal (N. D. Spec. 46M6) lined with anti-friction metal grade 2 (N. D. Spec. 46K2).

(j) Lantern rings and glands, gun metal (N. D. Spec. 46M6), or phosphor bronze grade I (N. D. Spec. 46B5).

(k) Mounting brackets for close coupled pumps, gun metal (N. D. Spec. 46M6) or class B cast steel (N. D. Spec. 49B1) for fresh water service only.

2. Pumps for refrigerating plant brine circulating service shall be of all iron construction.

-26-

847-2

847-2-kk. Design and construction.

1. Hydraulic unbalance due to the use of single inlet impellers shall not exceed 150 pounds.
2. Impeller wearing rings shall be fitted to all pumps of these classes having a rated capacity of 75 gallons per minute or more.
3. Casing wearing rings shall be fitted in all pumps of these classes.
4. Pump casing joints shall be made up using 1/32-inch compressed asbestos sheet gaskets.
5. All refrigerating plant brine pumps shall be insulated from their driving units and bedplates.
6. Horizontal class C-1 pumps driven by electric motors and having capacities under 1000 gallons per minute, may be of the close coupled type unless otherwise specified.
7. Class C-2 pumps shall, unless otherwise specified or approved be of the horizontal coupled type.
8. Class C-2 pumps for fire and flushing service and driven by both steam turbine and electric motor shall be fitted with over-running clutch couplings of an approved type between pump and turbine, and with a flexible coupling between pump and motor. Motor rotors shall be designed for and shall be tested for a speed 25 percent in excess of rated turbine speed. A mechanical interlock shall be fitted between turbine throttle and motor controller so arranged that the turbine throttle cannot be opened until motor is disconnected from the power supply.
9. When class C-1 and C-2 pumps cannot be so located in the vessel as to have a suction submergence, such units may be fitted with self-priming devices of an approved type, as described under class C-3 pumps, following.

Class C-3 Pumps

847-2-ll. Performance characteristics.

1. The characteristics of class C-3 pumps for bilge service including maximum suction lift and air removal capacity of vacuum pump for self-priming shall be as specified for each individual installation.
2. Air removal capacity of vacuum pump, hereinafter referred to as the primer, shall be not less than that required to remove air from suction line and start flow of water to the pump within 3 minutes.

347-2

-26-

347-2-mm. Materials.

1. The materials of class C-3 pumps shall be as specified for class C-1 and C-2 pumps supplemented by the following.
2. Materials for primers shall be in accordance with the following:
 - (a) Mounting brackets, gun metal (N. D. Spec. 46M6).
 - (b) Casings, including port plates and lobes, gun metal (N. D. Spec. 46M6).
 - (c) Rotor, gun metal (N. D. Spec. 46M6).
 - (d) Shaft, nickel-copper-aluminum alloy (N. D. Spec. 46N6) minimum hardness 285 Brinell, or same material as bilge pump shaft, if integral.
 - (e) Shaft sleeves, nickel-copper-aluminum alloy (N. D. Spec. 46N6) minimum hardness 285 Brinell.
 - (f) Gaskets, compressed asbestos sheet (N. D. Spec. 33F13) 1/64 inch thick.

347-2-mm. Design and construction.

1. Bilge pumping service shall not be combined with other pump services except where space considerations prohibit the use of separate pump shafts for bilge service only. Where such services are combined the primer shall be independently driven as specified hereinafter.
2. For close coupled motor driven bilge pumps the primer shall be installed as follows:
 - (a) Primer shall be mounted on end bell of driving motor, opposite to pump, with rotor mounted on an extension of motor shaft.
 - (b) An automatic priming valve shall be fitted that will prevent bilge water from being drawn into primer and to act to unload the primer after bilge pump receives water.
 - (c) A removable basket-type strainer and vacuum breaker shall be installed in line between pump and primer.

347-2

-27-

3. For horizontal bearing flexible coupled bilge pumps, the primer shall be independently driven by an electric motor and installed as follows:

- (a) Primer shall be mounted on the pump bedplate.
- (b) The primer shall be entirely automatic in operation, controlled by a pressure switch, and designed to start simultaneously with the bilge pump and to cut off automatically when bilge pump is primed.
- (c) Primer shall be designed to cut in automatically whenever the bilge pump loses its prime.
- (d) An automatic priming valve shall be located between pump and primer that will prevent water handled by a pump from entering the primer, and when primer is shut down to prevent air being drawn into the pump through the primer.
- (e) A removable basket-type strainer shall be fitted in line between pump and primer.

4. Primers for vertical bilge pumps shall be mounted and driven as specified or approved.

5. Motor driven primers for pumps driven by steam turbine or internal combustion engine shall be as specified above except that primer motor may be manually started but thereafter shall be under automatic control by means of the pressure switch.

6. A source of cleaning sealing water shall be provided for each priming unit. Sealing water may be taken from a fresh or sea water system that is constantly under pressure, or may be provided by means of a sealing water tank mounted adjacent to the pump. Particular attention shall be given to the importance of providing cold sealing water in order that the primer capacity will not be excessively reduced.

7. All class C-3 pumps shall be capable of running for at least 3 minutes before receiving water.

Class D-1 and D-2 Pumps

347-2-00. Performance characteristics.

1. Pumps in these classes of a capacity of 40 gallons per minute or more shall have a constantly rising head-capacity characteristic curve such that at constant rated speed the total head at shut-off is at least 15 percent in excess of the total head at rated capacity.

947-2

-20-

2. Pumps in these classes of a capacity of less than 40 gallons per minute shall have a constantly rising head-capacity characteristic curve such that at constant rated speed the total head at shut-off is at least 5 percent in excess of the total head at rated capacity.

3. Condensate pumps discharging into the same line and required to run in parallel shall have total heads at shut-off such that a pump of lower rated capacity will have a shut-off pressure at constant rated speed of at least 5 pounds per square inch in excess of a higher capacity pump.

4. The rotative speeds of class D-1 and D-2 pumps shall not exceed that indicated by Bureau of Engineering Standard sheet B-171 for a given capacity, vacuum and suction submergence.

947-2-pp. Materials.

1. Materials for class D-1 and D-2 pumps shall conform to the following:-

(a) Casings, gun metal (N. D. Spec. 46M5), or class B cast steel, (N. D. Spec. 4931)

(b) Casing bolts, steel (N. D. Spec. 45B11), or nickel-copper alloy, rolled, class a or b (N. D. Spec. 46M7).

(c) Diaphragm (interstage pieces), gun metal (N. D. Spec. 46M5), or class B cast steel (N. D. Spec. 4931).

(d) Diaphragm bushings, bearing bronze, grade 2 (N. D. Spec. 46B22).

(e) Impellers, nickel-copper-alloy, cast (N. D. Spec. 46M1).

(f) Impeller and casing wearing rings, nickel-copper alloy (N. D. Spec. 46M1 or 46M2), gun metal (N. D. Spec. 46M5), phosphor bronze, grade I (N. D. Spec. 46B3), or journal bronze (N. D. Spec. 46B9). A wearing ring and its opposing surface shall be of dissimilar metals.

(g) Shafts, fitted with shaft sleeves, class An or class B forged steel (N. D. Spec. 4932), nickel-copper alloy, rolled, class a (N. D. Spec. 46M7), or nickel-copper-aluminum alloy (N. D. Spec. 46M5).

(h) Shaft sleeves, nickel-copper-aluminum alloy (N. D. Spec. 46M5) minimum hardness 265 Brinell.

(i) Shafts without sleeves, nickel-copper-aluminum alloy (N. D. Spec. 46M5) minimum hardness 265 Brinell.

-29-

S47-2

(j) Bearing brackets or caps, gun metal (N. D. Spec. 46M6), or class B cast steel (N. D. Spec. 4931).

(k) Bearings, internal water lubricated, laminated phenolic material grade FBK (N. D. Spec. 1725), bearing bronze, grade 2 (N. D. Spec. 46B22), or special high lead content bronze of characteristics satisfactory to the Bureau.

(l) Lantern rings and glands, gun metal (N. D. Spec. 46M6) or phosphor bronze grade 1 (N. D. Spec. 46B6).

(m) Mounting brackets for driving units, gun metal (N. D. Spec. 46M6), or class B cast steel (N. D. Spec. 4931).

S47-2-qq. Design and construction.

1. Condensate pumps shall be single or two stage as approved or specified for the total head involved.

2. For class D-2 service, vertical pumps with single top inlet first stage impellers located at the bottom of the pump so as to have maximum possible submergence, shall be provided.

3. The pump casings of vertical condensate pumps shall be split vertically in such a manner as to allow the removal of the rotor without disturbing the pump on its foundations, the piping thereto, or the driving unit.

4. Where two stage pumps are provided, diaphragms (interstage pieces) shall be fitted with a bushing.

5. Pump casing joints shall be made up using a 1/64-inch compressed asbestos sheet gasket, except that for small horizontal close coupled pumps a 1/32-inch gasket will be acceptable.

6. Hydraulic unbalance due to the use of single inlet impellers shall not exceed 150 pounds.

7. Casing wearing rings shall be fitted in all pumps of these classes.

8. Impeller wearing rings shall be fitted to all pumps of these classes having a rated capacity of 75 gallons per minute or more.

847-2

-30-

9. The radial clearance between impeller and casing wearing rings shall be not less than indicated in the following table; all clearances to be measured on radius, i.e., the difference in diameters between the impeller and casing wearing rings shall be not less than twice the clearance given below.

<u>Rated Capacity</u> <u>G.P.M.</u>	<u>Clearance</u> <u>Inches</u>
249 and below	0.006
250 to 499	0.008
500 to 749	0.010
750 and above	0.012

10. All class D-1 and D-2 pumps shall be fitted with separate flanged suction vent connections, unless self venting pumps without separate vent connections are specifically approved. Evaporator brine overboard pumps shall be vented back to the evaporator shell from which suction is taken. All vent lines shall rise continuously from the pump to the condenser or evaporator shell. Each individual condensate pump shall be provided with a stop valve in the vent line adjacent to the condenser shell.

11. Gland seal piping for shaft packing of condensate pumps shall be taken from the combined condensate discharge piping. For evaporator brine overboard pumps the sealing water shall be taken from the distiller condenser circulating pump discharge.

Class E Pumps

847-2-rr. Performance characteristics.

1. Capacities of main feed booster pumps shall exceed the capacities of the corresponding feed pumps by at least 30 gallons per minute.
2. At constant rated speed class E pumps shall develop 120 percent rated capacity at a total head not less than 60 percent of the rated total head.
3. Class E pumps shall have a constantly rising head-capacity characteristic curve such that the total head at shut-off is at least 10 percent above total head at rated capacity.
4. All class E pumps shall operate satisfactorily in series with class A pumps and shall operate satisfactorily in parallel without surging under all conditions of operation from shut-off to full capacity.
5. Feed booster pumps shall have total heads at shut-off such that a pump of lower rated capacity will have a shut-off pressure at constant rated speed of at least 5 pounds per square inch in excess of a higher capacity pump.

-31-

B47-2

B47-2-ss. Materials.

1. The materials of class E pumps shall conform to the requirements for class D-1 and D-2 pumps (See paragraph B47-2-pp).

B47-2-tt. Design and construction.

1. Feed booster pumps shall be single or multi-stage as approved or specified for the total head involved.

2. The pump casing of vertical feed booster pumps shall be split vertically in such a manner as to allow the removal of the rotor without disturbing the pump on its foundation, the piping thereto, or the driving unit.

3. Where multi-stage pumps are provided, diaphragms (interstage pieces) shall be fitted with a bushing.

4. Pump casing joints shall be made up using a 1/64-inch compressed asbestos gasket except that for small horizontal close coupled pumps a 1/32-inch gasket will be acceptable.

5. Class E pumps shall be hydraulically balanced.

6. Casing and impeller wearing rings shall be fitted.

7. The radial clearance between casing and impeller wearing rings shall be as required for class D-1 and D-2 pumps (see subparagraph B47-2-qq-9).

8. All class E pumps shall be fitted with separate flanged vent connections from each feed booster pump suction casing to the feed tank. All vent lines shall rise continuously from the pumps to the feed tank. A stop valve shall be located in the vent line or lines adjacent to the feed tank.

TESTS

B47-2-uu. Type approval tests.

1. Type approval will be granted only as a result of service test or as a result of test conducted at the Engineering Experiment Station, Annapolis, Maryland. Tests will be authorized at the Engineering Experiment Station by the Bureau of Engineering at the expense of the exhibitor. The head, capacity and other characteristics of the unit for test shall be as arranged between the Bureau and the exhibitor.

347-2

-32-

2. To be granted type approval as the result of service tests the following requirements must be met.

(a) Two or more pumps of the same general design and general operating characteristics must have given satisfactory service on board a Naval vessel for a period of at least two years and must still be in service on such vessel at the time type approval is requested.

(b) When the design of pump in service for which manufacturer requests type approval does not meet current Naval requirements as regards head and capacity characteristics, the manufacturer will be required to furnish satisfactory evidence that he has produced pumps of a design, head and capacity characteristics equal to those currently required for Naval service. The Bureau reserves the right to require additional type approval tests of any design of pump which in its opinion has been changed sufficiently to require further demonstration of its suitability.

(c) Any manufacturer placed on the acceptable list as a result of service test will be required on his first contract or order after being granted type approval to submit a complete unit to the Engineering Experiment Station for a check test which will conform to the requirements for a type approval test. This test will be conducted at the expense of the manufacturer.

3. Separate type approval or service tests will be required on single and on multi-stage class A pumps.

4. Separate type approval or service tests will be required on vertical and on horizontal units under each class, except that type approval granted on vertical design may be extended to cover horizontal design also. In the case of class C-1 pumps, approval for vertical service may be extended where approval of horizontal C-1 and of vertical B, D-1 or D-2 pumps has already been granted.

5. Separate type approval or service tests will be required on centrifugal and on axial or mixed flow pumps under class B or C-1.

6. Type approval tests on class E pumps will not be made at the Engineering Experiment Station. Type approval tests for this class will be made at the works of the manufacturer or elsewhere under conditions to be arranged with and to the satisfaction of the Bureau.

7. Type approval of class E-3 pumps will be considered as having been met where pump manufacturer proposes the use of a priming unit which has been granted type approval, in combination with an approved class C-1 pump.

8. Separate type approval tests on class E pump will not be required if manufacturer is already on the acceptable list for class A and class D-2 pumps, otherwise type approval tests will be required.

-33-

247-2

9. Three bearing, close coupled or rigid coupled centrifugal pumps in which a common shaft or extension thereof, without flexible coupling, serves both the pump and its driving unit, shall be tested for type approval with its driving unit. In the case of class A pumps type approval on a 3 bearing pump will be extended to 4 bearing units, but a type approval test on a 4 bearing unit will apply to that design only.

247-2-xx. Shop tests.

1. Pump casings shall be tested hydrostatically to a pressure one and one-half times the maximum rated discharge pressure or total head which ever is greater, but in no case to less than 80 pounds per square inch gage.

2. Pumps for submarine circulating systems which are subjected to sea pressure shall withstand a hydrostatic test pressure equal to one and one-half times designed submergence pressure of the vessel plus one and one-half times total head of the pump.

3. All class C-3 pumps and other self priming centrifugal pumps shall demonstrate their ability to run for at least 3 minutes before receiving water, and this test shall be repeated 5 times on each unit.

4. All pumps on order, except those driven by alternating current motors shall be tested in the shop of the manufacturer or contractor at 25 percent above designed maximum operating speed by a continuous non-stop run of at least 30 minutes. This test shall be conducted in the presence of the Bureau's inspector, who will check operation and smoothness of running. While running at this speed the pump need not be loaded except as required to prevent injury, as this test is to insure proper strength and balance. For 4 bearing and geared units, these tests may be conducted with or without the driving units and gear units, provided the driving units and gear units have already been independently tested in the same manner. For continuous or rigid coupled shaft sets, these tests shall be made with the driving units connected in place. In the case of pumps driven by alternating current motors each unit shall be tested for balance and smoothness of operation at full load and full speed.

247-2-yy. Performance acceptance tests.

1. The driving unit shall be tested as required by the applicable Subsection.

2. One pump of each type and size on contract or order, as selected by the Bureau's inspector, complete including the turbine and reduction gear, if used, or the motor and controller, shall be given a test to determine the overall power or steam consumption of the unit under the specified or guaranteed conditions. This test may be conducted in the shop of the main contractor or subcontractor as arranged with the Bureau. The Bureau may consider waiver of overall power or steam consumption tests on centrifugal pumps where identical units with identical guarantees have been previously tested.

S47-2

-34-

3. For turbine driven pumps, the functioning of the speed governors shall be carefully observed during these tests, and all adjustments that may be necessary to insure satisfactory operation at all normal operating speeds shall be made before the units are accepted. The governors shall function as specified in Subsection 350-1, and those on units not included in the shop test shall be tested after installation aboard the vessel. When pressure regulating governors are specified, the foregoing requirements shall apply to this equipment also, and compliance with Subsection 347-2 shall be demonstrated.

4. This test shall ordinarily be conducted at the same time as, and shall include the inclined operation tests as specified for the driving unit. For inclined operation tests, the unit shall be run at maximum operating speed, but need not be fully loaded. For requirements as to inclined operating tests see applicable Subsections for driving units; auxiliary turbines (Subsections 350-1 and 350-2); motors (Subsection 350-1), and lubrication systems (Subsection 345-1).

5. Performance acceptance tests shall adequately demonstrate the ability of the pump to handle its rated capacity of specified liquid at the maximum temperature and minimum suction head or maximum suction lift or vacuum.

6. Sufficient data shall be taken during the tests to prepare pump characteristic curves as required below. In all cases the test data shall be corrected to the specified operating conditions as to steam pressure and temperature, exhaust pressure, voltage, frequency, temperatures, specific gravity, suction head or lift, vacuum, etc., as set forth in the contract or order; such conditions shall be clearly shown on the data sheets. Data sheet shall state the actual finished diameter of pump impellers installed on test. Test data and curves shall be complete over the entire range of capacities from shut-off to as near free delivery as possible.

7. The following test curves shall be supplied for all classes of pumps at constant speeds of approximately 90, 100 and 110 percent of designed speed. Where pumps are driven by constant or multi-speed alternating current motors the curves required below shall be obtained for the rated speed conditions of the motor in lieu of those noted above.

- (a) Capacity versus total head or discharge pressure.
- (b) Capacity versus pump efficiency.
- (c) Capacity versus brake horsepower.
- (d) Capacity versus steam consumption or electrical horsepower input.

-35-

347-2

8. The basic test curves required above shall be supplemented by the following additional curves for individual classes of pumps.

(a) Class A pumps; curves of capacity versus revolution per minute, and capacity versus steam consumption at constant discharge pressure of 80, 90 and 100 percent of normal discharge pressure.

(b) Class B pumps; curves of capacity versus total head, efficiency, brake horsepower, and steam consumption at a suction lift of 15 feet and at a constant speed as required to meet the bilge pumping condition specified in paragraph 347-2-ff-1.

(c) Class C-3 pumps; curves of capacity versus total head at constant rated speed with suction lifts of approximately 60, 80, 100 and 110 percent of designed suction lift.

(d) Priming units; curves of vacuum versus air capacity at the vacuum, air capacity in free air, efficiency, and brake horsepower at constant rated speed.

(e) Class D-1 and D-2 pumps; curves of capacity versus total head at constant rated speed and designed vacuum and at suction submergences of approximately 70, 85, 100 and 125 percent of designed submergence.

(f) Class E pumps; curves of capacity versus total head at constant rated speed and at suction heads of approximately 75, 100, and 125 percent of designed suction head with constant rated water temperature.

9. To simplify the foregoing requirements the Bureau may, when requested, authorize separate tests of the driving unit including reduction gear, if used, and driven unit constituting an assembly, at the works of different manufacturers and will accept overall power and steam consumption results and characteristic curves computed from the results therefrom. This shall not be construed in any way to release the primary contractor from an operating run on one completely assembled unit from each contract or contracts on hand at the same time for identical units. This operating test shall be run with the unit fully loaded and shall demonstrate all requirements of the specifications as to thrust, governing, balance, lubrication, etc., at maximum operating speed.

10. Complete test reports including test data on both pump and driving units shall be assembled and distributed as specified in Subsection 51-1.

347-2

-36-

347-2-xx. Shipboard tests.

1. After installation, alignment shall be carefully checked and a careful running test made to check practical performance, including all governing features and parallel operation, if required.

2. Bilge pumping tests on main circulating pumps after installation are not required. The ability of such units to pump bilges shall be demonstrated during performance acceptance tests at manufacturer's shop.

SPARE PARTS AND TOOLS

347-2-yy. Spare parts.

1. All spare parts for pumps of a given type and size furnished on the same contract shall be strictly interchangeable.

2. The following spare parts shall be furnished to each vessel for each size and type of pump, to be carried on board and included in the penalty weight. All spare parts shall be boxed as required by Subsection B31-1. Boxing shall not be included in penalty weights.

Parts as applicable to pump furnished	Quantities furnished per vessel							
	1	2	3	4	5	6	7	8
Number similar pumps per vessel	1	2	3	4	5	6	7	8
(a) Ball bearings, complete sets	1	2	3	4	5	6	7	8
(b) Sleeve bearings, complete sets	1	1	1	1	2	2	2	2
(c) Internal water lubricated bearings, sets	1	2	3	4	5	6	7	8
(d) Pivoted segmental bearings complete	1	1	1	1	2	2	2	2
(e) Diffusion vanes, sets	1	1	1	1	1	1	1	1
(f) Rotors, completely assembled, including shaft, impellers, impeller and casing wearing rings, casing, diaphragms and bushings, drums, sleeves, keys, nuts and complete coupling	1	1	1	1	1	1	1	1
(g) Oversize impeller wearing rings, sets	1	1	1	1	2	2	2	2
(h) Oversize casing wearing rings, sets	1	1	1	1	2	2	2	2
(i) Diaphragm bushings, sets	1	1	1	1	2	2	2	2
(j) Pressure breakdown drum bushings, sets	1	1	1	1	2	2	2	2
(k) Stuffing box throat bushings, sets	1	1	1	1	2	2	2	2
(l) Coupling bushings and pins or other wearing parts, sets	1	2	3	4	5	6	7	8
(m) Lubricating oil pumps complete including drive shafting and gears	1	1	1	1	2	2	2	2
(n) Oil pump gears, sets, (in addition to item (m))	1	1	1	1	2	2	2	2
(o) Felt wiper rings or oil seals, sets	1	2	3	4	5	6	7	8
(p) Special packing, sets	1	2	3	4	5	6	7	8
(q) Lantern rings, sets	1	1	2	2	3	3	4	4

-37-

S47-2

3. Spare pump rotors, item (f) above, shall be completely assembled ready for installation on the unit for which intended. This shall be interpreted to include any non-rotating parts which can be installed only by removing some rotating part or parts of the pump rotor. For pumps with shafts common to both pump and driving turbine, such as boiler feed pumps and in some instances main circulating pumps, the spare turbine rotor and removable parts in way of turbine, including governor parts, shall be separately packed. In the case of close coupled motor driven pumps designed for withdrawal of impellers, the impeller and pump parts may be furnished disassembled. All other spare pump rotors having common shafts shall be completely assembled, including rotating parts of the driving units unless otherwise specifically approved by the Bureau.

4. The quantities of spare parts listed above for all items shall not be reduced by reason of the same part being furnished with spare rotor, item (f).

5. Casing and impeller wearing rings, items (g) and (h) above, shall be machined undersize and oversize as applicable by at least 0.015-inch in order to permit finish machining as required for replacement on board ship.

S47-2-ix. Tools.

1. The following special tools shall be supplied to each vessel for each size and type of pump installed:

(a) Complete set of special wrenches for each machinery compartment in which pumps are installed, arranged for convenient and accessible storage. No ordinary commercial tools should be included in such sets. Wrenches should be of forged steel with hardened jaws.

(b) One jacking tool for removing impellers from shaft.

(c) One set of babbitting mandrels with collars, complete, for renewing white metal of all bearings.

(d) One set of ball bearing pulling tools.

(e) Any other special tools or equipment, which in the opinion of the Bureau or the Bureau's inspector are necessary for the proper maintenance of the pump units in service.

Subsection S47-2 Centrifugal and Axial Flow Pumps
(Edition of 1 August 1939)

Par. S47-2-b. Reference Navy Dept. Specifications
Insert the following in its proper alphabetical
location: "Coolers, lubricating oil and jacket
water .. 6601". (82)

Par. S47-2-n. Lubrication.
Subpar. 5, second sentence. Delete "Subsection
S45-1" and substitute therefor "Navy Dept. Spec-
ification 6601." (82)

CHANGE "BUREAU OF ENGINEERING" AND "BUREAU OF CON-
STRUCTION AND REPAIR" TO READ "BUREAU OF SHIPS." (82)

MIL-P-17839(SHIPS)
8 October 1953
~~SUPERSEDING~~
S47-2 (in part)*
1 August 1939

MILITARY SPECIFICATION
PUMPS, CENTRIFUGAL, MISCELLANEOUS SERVICE,
FOR USE ON NAVAL SHIPS

1. SCOPE

1.1 Scope. - This specification covers the requirements applicable to the design and construction of centrifugal pumps for miscellaneous services aboard Naval ships.

1.2 Classification. - Pumps shall be of the following classes as specified (see 6.1):

Class C-1 - Pumps with overhung impellers (other than Navy standard close-coupled).
Class C-2 - Pumps with impeller between bearings, split case.

2. APPLICABLE SPECIFICATIONS, STANDARDS, DRAWINGS, AND PUBLICATIONS

2.1 The following specifications and drawings, of the issue in effect on date of invitation for bids, form a part of this specification:

SPECIFICATIONS

FEDERAL

GGG-P-781 - Pullers, Bushing, Bearing, Gear, Wheel Hub and Cylinder Sleeve, Installing and Removing.

MILITARY

MIL-B-857 - Bolts, Nuts, Studs, and Tap Rivets (and Material for Same).

MIL-S-890 - Steel; Forgings and Bars for Hulls, Engines, and Ordnance (Heat-Treated).

MIL-B-892 - Bronze, Phosphor, Rolled or Drawn; Bars, Plates, Rods, Sheets, and Strips.

MIL-N-894 - Nickel-Copper-Alloy: Wrought.

MIL-S-901 - Shockproof Equipment, Class EI (High-Impact), Shipboard Application, Tests for.

MIL-D-963 - Drawings, Production (for Electrical and Mechanical Equipment for Naval Shipboard Use).

MIL-B-994 - Brass, Naval, Wrought.

MIL-C-2174 - Controllers and Master Switches, Direct-Current (Naval Shipboard Use).

MIL-C-2212 - Controllers and Master Switches, Alternating-Current (Naval Shipboard Use).

MIL-I-15024 - Identification Plates, Information Plates and Marking Information for Identification of Electrical, Electronic and Mechanical Equipment.

MIL-B-15071 - Books, Instruction, Preparation, Contents, and Approval.

MIL-S-15083 - Steel; Castings.

MIL-R-15137 - Repair Parts for Electrical and Mechanical Equipment (Naval Shipboard Use).

MIL-E-15163 - Engines, Diesel, Commercial-Type.

MIL-T-16243 - Tools, Nonsparking.

MIL-B-16261 - Bronze, Bearing: Castings.

MIL-B-16540 - Bronze, Phosphor: Castings.

MIL-B-16541 - Bronze, Valve: Castings.

*See 6.3

DEFENDENT'S
EXHIBIT
Buffalo Pumps

MIL-P-17639(SHIPS)

MILITARY (cont'd.)

- MIL-M-16576 - Metal, Gun: Castings.
- MIL-P-16789 - Preservation, Packaging, Packing, and Marking of Pumps, ~~Centrifugal, Gase, Coupled, Navy Standard, General~~
- MIL-M-17059 - Motors, Alternating-Current, Fractional HP (Shipboard Use).
- MIL-M-17080 - Motors, Alternating-Current, Integral HP (Shipboard Use).
- MIL-M-17413 - Motor, Direct-Current, Integral HP (Shipboard Use).
- MIL-N-17506 - Nickel-Copper-Aluminum Alloy, Wrought.
- MIL-B-17511 - Brass, Naval: Castings.
- MIL-T-17523 - Turbine Steam General Auxiliary (Naval Shipboard Use).
- MIL-M-17556 - Motor, Direct-Current, Fractional HP (Shipboard Use).
- MIL-N-20164 - Nickel-Copper-Alloy: Castings.

NAVY DEPARTMENT

- General Specifications for Inspection of Material.
- 42B5 - Bearings, Ball.
- 42B10 - Bearings, Roller.
- 46M2 - Metal, Antifriction: Ingots and Castings.
- 46B15 - Bronze, Manganese, Wrought: Bars, Forgings, Plates, Rods, Shapes, Sheets, and Strips.

BUREAU OF SHIPS

- General Specifications:
- Appendix 6 - Instructions for Painting.
- General Specifications for Machinery:
- Section S1-3 - Bolts, Bolt-Studs, Stud-Bolts, Studs, Screws, and Nuts.
- Section S1-4 - Welding and Allied Processes.
- Section S47-6 - Pump Pressure Regulating Governors (Steam-Driven Pumps).
- Section S87-3 - Gages, Pressure and Vacuum.
- Section S87-4 - Thermometers.

DRAWINGS

BUREAU OF SHIPS

- B-104 - Flanged Composition Pipe Fittings, 100 P.S.I. and Below 425° F.
- B-105 - Flanged Composition Pipe Fittings, 101 to 200 P.S.I. Steam Service.
- B-153 - Packings and Gaskets, Standard Application of.
- B-176 - Flanges, Composition, Silver Brazing, for Copper and Copper-Nickel-Alloy, Tubing and Brazed Pipes, Pressures 100 Pounds and Below.
- B-177 - Flanges, Composition, Silver Brazing, for Copper and Copper-Nickel-Alloy Tubing, 1/4 to 10 Inches, Inclusive, Pressures, Steam-Service, 101 to 200 Pounds Hydraulic and Pneumatic Services, 101 to 400 Pounds.
- B-214 - Root Connections for Attaching Piping.
- 5000-S4800-3000 - Piping Schedule, Pipe Fittings, Valves, and Types of Joints Used in Piping Systems.

(Copies of specifications, standards, and drawings required by contractors in connection with specific procurement functions should be obtained from the procuring agency or as directed by the contracting officer.)

2.2 Other publications. - The following publication, of the issue in effect on date of invitation for bids, unless otherwise stated, forms a part of this specification:

NATIONAL BUREAU OF STANDARDS PUBLICATION

Handbook H28 - Screw Thread Standards for Federal Services.

Application for copies should be addressed to the Superintendent of Documents, Government Printing, Washington 25, D.C.)

MIL-P-17639(SHIPS)

3. REQUIREMENTS

3.1 Qualification. - Pumps furnished under this specification shall be of a product which has been tested and has passed the qualification tests specified in section 4 (see 6.2).

3.2 Materials. -

3.2.1 All material used in the construction of the pumps and associated equipment shall be of the quality best suited for the purpose intended, and shall be strictly in accordance with the material specifications.

3.2.2 The use of materials differing in properties from those specified for a given application will be considered when the contractor shows the necessity for such substitution, the material proposed is readily obtainable, and provided that the material is satisfactory to the bureau or agency concerned.

3.2.3 Where no specifications are specified herein for the material for certain parts, the material used shall be of a type and quality consistent with that specified for associated parts in the pump. The use or substitution of manufacturer's material shall be subject to approval by the bureau or agency concerned and shall be clearly indicated in a list submitted with the master drawings.

3.3 General design. -

3.3.1 The principle of reliability is paramount and no compromise of this principle shall be made with any other basic requirements of design. It is the intention of this specification to obtain pumps of such design that they will operate over a long period of years with a minimum of servicing. Where wear or erosion is unavoidable, the parts subjected to such wear or erosion shall be of the best materials available for the purpose in order to reduce these detrimental effects to a minimum. The design and construction of all pumps shall be the most compact consistent with the following requirements:

- (a) Reliability
- (b) Accessibility for repair
- (c) Resistance to wear or corrosion
- (d) Economy
- (e) Satisfactory operation when inclined as follows:
 - (1) Up to 5 degrees for submarines, from the normal horizontal position in the plane of axis (permanently inclined) for surface ships; and for submarines, 7 degrees for machinery for surface operation, 15 degrees for machinery for submerged operation.
 - (2) Up to 15 degrees to either side (permanently inclined).
 - (3) With the ship rolling up to 45 degrees from the vertical to either side.
 - (4) With the ship pitching 10 degrees up and down from the normal horizontal plane.

Note. - Horizontal pumps are normally in a ship with the shaft in the fore and aft position.

3.3.2 Mounting. -

3.3.2.1 Pump units shall be horizontal or vertical mounted as specified (see 6.1).

3.3.2.2 Each horizontal flexible or rigid coupled pump and separable driving unit, complete with all appurtenances, shall be mounted on a common bedplate.

3.3.2.3 Bedplates shall be of cast steel, class CW of Specification MIL-S-15083, or of structural steel fabricated by welding.

MIL-P-17639(SHIPS)

3.3.2.4 Bedplates shall be sufficiently rigid to permit handling, shipment, and installation of the units onboard ship, without disturbing the alignment of the assembled units; and such that the normal distortion, weaving or vibration of the supporting structures onboard ships cannot cause misalignment between the pumps and driving units.

3.3.2.5 All bearing and seating surfaces of bedplates shall be finish machined.

3.3.2.6 Each component part of an assembled unit supported directly by a bedplate shall be doweled thereto to facilitate reassembly and maintenance of alignment.

3.3.2.7 In the event special bulkhead mounting is required, sideplates shall be furnished subject to all conditions specified for bedplates.

3.3.2.8 When motor driven pumps of the close-coupled type are specified, bedplates will not be required. Each pump shall be provided with a support for bolting to the foundation to augment the support from the motor frame.

3.3.2.9 Vertical pumps shall be base-mounted unless otherwise specified in the contract or order. The base shall have provisions for bolting to foundation.

3.3.2.10 Special attention shall be given the design of close-coupled type pumps to insure that leakage from the pump stuffing box glands cannot enter motor frames or bearing brackets.

3.3.3 Bearings.

3.3.3.1 Types.

3.3.3.1.1 Radial and thrust bearings may be of the sliding contact or rolling contact types.

3.3.3.1.2 The use of rolling contact bearings shall be subject to the speed limitations of Specifications 42B5 and 42B10 except where prior approval of the bureau or agency concerned has been granted.

3.3.3.1.3 Sliding contact radial bearings may be of the fixed or self-aligning type.

3.3.3.2 Installation.

3.3.3.2.1 Bearings shall be installed in housings separate from and independent of the stuffing boxes and with adequate protection from gland leakage. Suitable means shall be provided to prevent escape of oil around the shaft. All baffles, wipers and related parts shall be readily renewable.

3.3.3.2.2 Bearing brackets shall be either cast integral with the casing, securely bolted to the casing on a machined shoulder, or held in alignment with the casing by at least two heavy dowels and securely bolted thereto. The use of bolts alone for securing brackets is prohibited.

3.3.3.2.3 Bearing housings shall be cast integral with the bracket or secured thereto in such a manner as to insure alignment.

3.3.3.2.4 Sliding contact radial bearing shells shall be split along the axis and so arranged as to permit renewal or refitting without removal of the pump rotor from the casing. They shall be neatly fitted in their seating to prevent axial play. Shells and their seatings shall be finish machined.

3.3.3.3 Radial bearings.

3.3.3.3.1 Rolling contact bearings for radial load and their installation shall be in strict accordance with Specification 42B5 or 42B10, as applicable.

3.3.3.3.2 Water lubricated sliding contact bearings shall not be furnished for salt water service.

MIL-P-17639(SHIPS)

3.3.3.4 Thrust bearings. -

3.3.3.4.1 A suitable thrust bearing shall be installed on each pump for counteracting any unbalanced hydraulic or mechanical thrust in either direction. In this connection consideration shall be given to the fact that rolling, pitching or list of a ship at sea may introduce thrust loads even though the unit is in hydraulic balance.

3.3.3.4.2 Thrust bearings may be of the combined radial and thrust rolling contact type or pivoted segmental type.

3.3.3.4.3 Combined radial and thrust bearings shall preferably be type C, class b or c, single row, angular contact, duplex mounted, ball bearings in accordance with Specification 42B5; or type C or D, class a, b, or c roller bearings in accordance with Specification 42B10.

3.3.3.4.4 When pivoted segmental type thrust bearings are used, the design shall be such as to permit renewal or refitting of shoes without removal of shafts.

3.3.3.4.5 Thrust bearings for vertical, flexible coupled pumps shall be installed at the tops of the pumps.

3.3.4 Lubrication. -

3.3.4.1 The lubrication of ball bearings shall be in accordance with Specification 42B5.

3.3.4.2 Where forced feed lubrication is provided for turbine-driven pumps, the lubricating system shall be in accordance with Specification MIL-T-17523.

3.3.4.3 All thrust bearing housings, particularly for bearings of the pivoted segmental type, shall be so designed that the thrust bearings will be adequately lubricated immediately when the shaft starts to turn. This shall be accomplished by properly locating oil supply and drain pipes, and by adequate sealing of the bearing housings so that, regardless of the length of time the units are idle, an adequate supply of oil will remain in the bearing housings.

3.3.5 Pump pressure regulating governors. -

3.3.5.1 One pump pressure regulating governor in accordance with Section S47-6 of General Specifications for Machinery shall be furnished with each turbine-driven pump for fire, or fire and flushing service unless otherwise specified in contract or order.

3.3.5.2 The steam pressure drop through pump pressure regulating governors should be considered when rating turbine driven pumps.

3.3.6 Piping and valves. -

3.3.6.1 All valves, flanges and fittings for pipe connections shall conform to Drawing 5000-S4800-3000.

3.3.7 Pump units which are required to be self-priming shall be of a type approved by the bureau or agency concerned.

3.3.8 Turbines. -

3.3.8.1 All turbines for driving pumps shall be in accordance with Specification MIL-T-17523. Attention is directed particularly to the requirements regarding approved designs.

3.3.9 Diesel engines. -

3.3.9.1 All Diesel engines for driving pumps shall be in accordance with Specification MIL-E-15163.

MIL-P-17639(SHIPS)

3.3.10 Gasoline engines. -

3.3.10.1 All gasoline engines for driving pumps shall be as specified in the contract or order.

3.3.11 Motors. -

3.3.11.1 All motors for driving pumps shall be of the types and characteristics specified in the contract or order, and shall conform to Specifications MIL-M-17413 and MIL-M-17556 for direct current motors, or Specifications MIL-M-17059 and MIL-M-17060 for alternating current motors.

3.3.11.2 Motor rotors for use on dual turbine and motor driven pumps shall be designed and tested for a speed 25 percent in excess of rated turbine speed.

3.3.11.3 The horsepower rating of each motor shall be not less than the maximum brake horsepower of the driven pump under any condition from shut-off to free delivery. The actual motor rating shall be in accordance with Navy standard motor ratings. If the maximum brake horsepower of the pump is less than 2, and if there is a possibility of an unpredictably high frictional load due to improper adjustment of the gland or to some other cause, then the maximum brake horsepower shall be multiplied by a safety factor of 1.5 = (max. BHP) before selecting the next larger Navy standard rating.

3.3.12 Controllers. -

3.3.12.1 All motor controllers shall be of the characteristics specified (see 6.1) and shall conform to Specification MIL-C-2174 for direct current controllers or Specification MIL-C-2212 for alternating current controllers.

3.3.13 Pressure and vacuum gages. -

3.3.13.1 All pressure and vacuum gages furnished with the units shall be in accordance with Section S87-3 of General Specifications for Machinery.

3.3.14 Thermometers. -

3.3.14.1 All thermometers shall be in accordance with Section S87-4 of General Specifications for Machinery.

3.3.15 Shockproofness. -

3.3.15.1 The design of all complete pumping units shall be such that they are capable of passing the class HI (high-impact) shock test specified in Specification MIL-S-901.

3.3.15.2 Shockmounts are not to be used unless bureau or agency approval of the mount and its proposed application is given.

3.3.15.3 The determination of stresses resulting from the shock tests is accomplished by the application of the usual methods of analytical mechanics. The allowable stress in components due to shock shall be the yield strength (0.2 percent offset) of the material. Normal stresses in parts, such as the tensile stress in a bolt due to initial pull-up, shall not be added to the shock stresses. It is of paramount importance that the maximum accelerations possible under the shock tests be utilized in the design of holding down bolts, supporting feet or lugs, and main structural members of the equipment, and that no failure or permanent deformation occur as a result of shock. Components of an assembly mounted on a common rigid base need not be designed for higher accelerations than the values for which the whole assembly is designed unless the designer has reason to believe that higher accelerations will be experienced by the components.

MIL-P-17639(SHIPS)

3.3.15.4 Bolts designed to be stressed in shear shall be installed in holes with a minimum of clearance, as experience indicates that large clearances allow impacting and subsequent failure.

3.3.16 Casings. -

3.3.16.1 The casings of all flexible or rigid coupled pumps shall be divided into two parts so as to permit ready removal of the rotors and replacement of bearings and glands.

3.3.16.2 The casings of all close-coupled pumps shall be designed to permit ready replacement of wearing parts.

3.3.16.3 Sufficient clearance shall be provided around bolt heads and nuts to permit the use of ordinary tools.

3.3.16.4 Fitted bolts or heavy dowel pins shall be provided in class C-2 pumps to insure maintenance of alignment of casing halves in reassembly.

3.3.16.5 Forcing bolts shall be provided in class C-2 pumps for breaking joints.

3.3.16.6 All pumps shall be fitted with drain connections:

3.3.16.7 All pumps shall be fitted with vent connections and valves on the discharge casings of each stage.

3.3.16.8 All pumps shall be fitted with flanged connections, for suction and discharge pressure gauges, conforming to Drawing B-214.

3.3.17 Suction and discharge connections. -

3.3.17.1 Suction and discharge connections shall be flanged.

3.3.17.2 Suction and discharge connections shall in general be located on the bottom or fixed half of casings except on close-coupled pumps.

3.3.17.3 Suction and discharge connections shall be in accordance with Drawings B-176, B-177, B-104, and B-105, as applicable.

3.3.18 Impellers and shafts. -

3.3.18.1 Outside surfaces of impellers shall be smooth finished, and inside surfaces shall be file finished insofar as practical.

3.3.18.2 Impellers shall be keyed on the shaft and securely held against lateral movement by locked nuts or other means approved by the bureau or agency concerned.

3.3.18.3 Impellers shall be fitted with removable wearing rings except as otherwise specified (see 3.4.1.3) under detail requirements of the individual class of pump.

3.3.18.4 Shaft threading shall be counter to the direction of rotation except where both right hand and left hand units of the same design are involved; in which case, in order to reduce the number of shafts required for repair parts, the threading shall be right hand for all units and the threaded parts shall be locked in place.

3.3.18.5 Shafts shall be fitted with shaft sleeves in way of stuffing boxes, diaphragm bushings and water-lubricated bearings.

3.3.18.6 Shaft flingers shall be provided adjacent to stuffing boxes for all pumps.

MIL-P-17639(SHIPS)

3.3.18.7 The shafts of all pumps, except those driven by alternating current motors, shall be provided with means to permit the ready and direct use of portable tachometers.

3.3.19 Stuffing boxes and packing.

3.3.19.1 Stuffing boxes shall be of adequate depth and design to reduce leakage to a minimum under all operating conditions.

3.3.19.2 Packing shall be in accordance with Drawing B-153. All packing shall be of a brand approved by the bureau or agency concerned.

3.3.19.3 All stuffing boxes shall be fitted with throat bushings.

3.3.19.4 The stuffing boxes of all pumps shall be fitted with water seal connections and lantern rings located between inner and outer sets of packing. Pumps shall be furnished complete with water seal pipes, fittings and valves as required. Special care shall be taken in the design to insure that compression of the inner packing will not allow the lantern rings to move sufficiently to cut off or restrict the sealing water supply. In any special design where a water lubricated bearing is approved by the bureau or agency concerned, consideration will be given to the use of a combination lantern ring, throat bushing and bearing, in which case the inner rings of packing may be omitted.

3.3.19.5 The design shall be such as to insure that leakage from the glands cannot reach the bearings or be thrown over bearing housings or driving units. This shall preferably be accomplished by using glands cored out internally and the shafts provided with flingers. Ample drip pockets, spray shields and drains shall be provided.

3.3.19.6 Gland and lantern rings shall be split in halves with the halves secured together in a manner to form solid rings for setting up.

3.3.19.7 All stuffing box glands shall be set up by nuts threaded on gland swing bolts, or on studs secured in the castings.

3.3.19.8 Sufficient space shall be provided between bearings and stuffing boxes to permit easy removal of packing, and inspection and overhaul of bearings.

3.3.19.9 All pumps for liquids having fumes which are toxic or explosive shall be provided with mechanical shaft seals unless otherwise specified in the contract or order.

3.3.20 Couplings.

3.3.20.1 For horizontal or vertical 4-bearing units an all metal flexible coupling shall be installed between the pumps and driving units.

3.3.20.2 All flexible coupling hubs shall be keyed to the shafts and secured by lock nuts. For shafts one inch in diameter and larger the hubs shall be fitted on a taper with keys parallel to the tapers.

3.3.20.3 All rigid couplings shall have fitted bolts and the coupling flanges shall be marked at assembly to insure proper reassembly after overhaul of the units.

3.3.21 Fittings.

3.3.21.1 The bottom of all pump casings shall be fitted with suitable connections to permit complete draining of the pumps.

3.3.21.2 The bottom of all drip pockets shall be pipe tapped for drain connections.

3.3.21.3 The tops of all pump casings shall be fitted with vent connections.

MIL-P-17839(SHIPS)

3.3.22 Threaded parts such as bolts, studs and nuts shall conform to Section S1-3 of the General Specifications for Machinery and Handbook H28.

3.3.23 Painting shall be in accordance with the applicable sections of Appendix 6 of General Specifications.

3.3.24 Welding shall be in accordance with Section S1-4 of General Specifications for Machinery.

3.3.25 Identification plates. -

3.3.25.1 Identification plates shall be furnished on each pump and shall be type A or B in accordance with Specification MIL-I-15024, except that identification plates of plastic or aluminum are not acceptable.

3.3.25.2 Identification plates shall be secured to equipment with corrosion resistant metallic screws.

3.3.25.3 Pump identification plates shall contain data as follows:

- (a) Manufacturer's name.
- (b) Manufacturer's model or type and size.
- (c) Service application.
- (d) Manufacturer's serial number.
- (e) Salient design characteristics:
 - (1) Capacity in gallons per minute.
 - (2) Total head in pounds per square inch.
 - (3) Speed of shaft in revolutions per minute.
 - (4) Brake horsepower.
 - (5) Test pressure.
 - (6) Special data vital to the unit:
 - (a) Suction pressure.
 - (b) Submergence.
 - (c) Impeller diameter.
- (f) Contract number (and item number for multiple unit orders).
- (g) Bureau of Ships stock number.
- (h) Section for inspector's stamp.

3.3.25.4 Each driving unit and each accessory unit shall have an identification plate in accordance with the applicable equipment specification.

3.4 Detail requirements. -

3.4.1 Class C-1 pumps. -

3.4.1.1 The preferred design for class C-1 pumps shall be of the single stage, single suction, volute type.

3.4.1.2 Class C-1 pumps shall have constantly rising head-capacity characteristic curves. Pumps with capacities of 50 gallons per minute or more shall have head-capacity characteristic curves such that total head at shut-off is not less than 10 percent above total head at rated capacity.

3.4.1.3 Impeller wearing rings shall be fitted to pumps of this class requiring a driver rated at 10 HP or more.

3.4.1.4 Casing wearing rings shall be fitted in all pumps of this class.

3.4.1.5 Pump casing joints shall be made up using compressed asbestos sheet gaskets.

MIL-P-17639(SHIPS)

3.4.1.6 Class C-1 pumps driven by electric motors of 25 HP or less shall be of the close-coupled type unless otherwise specified in the contract or order.

3.4.1.7 Materials for class C-1 pumps shall be as specified in table I.

Table I - Materials for class C-1 pumps.

Application	Material	Specification
Casings	Gun metal	MIL-M-16576
Casing bolts	Valve bronze	MIL-B-16541
Salt water service	Nickel-copper-alloy rolled, class a or b	MIL-N-894
	Naval brass	MIL-B-894
	Manganese bronze	46B15
Fresh water service	Steel	MIL-B-857
Impellers	Nickel-copper-alloy, cast	MIL-N-20164
	Gun metal	MIL-M-16576
Under 100 foot head only	Valve bronze	MIL-B-16541
Impeller and casing wearing rings	Nickel-copper-alloy	MIL-N-20164 or MIL-N-894
	Gun metal ✓	MIL-M-16576
	Phosphor bronze, grade I	MIL-B-16540
	Bearing bronze, grade II, or grade III	MIL-B-16261
Shafts		
Salt water service	Nickel-copper-aluminum alloy	MIL-N-17506
	Nickel-copper-alloy rolled, class a or b	MIL-N-894
Fresh water service	Forged steel, class A or B	MIL-S-890
	Nickel-copper-alloy rolled, class a	MIL-N-894
Shaft sleeves	Nickel-copper-aluminum alloy minimum hardness 265 Brinell	MIL-N-17506
Bearing brackets and caps	Gun metal	MIL-M-16576
	Valve bronze	MIL-B-16541
Bearing shells for oil lubricated sleeve bearings	Cast steel or gun metal, lined with antifriction metal, grade 2	MIL-M-16576
Lantern rings, glands and throat bushings	Gun metal	46M2
	Phosphor bronze, grade I	MIL-M-16576
	Valve bronze	MIL-B-16540
Mounting brackets for close-coupled pumps	Gun metal, or valve bronze	MIL-M-16576
Impeller nuts	Gun metal	MIL-B-16541
	Nickel-copper-alloy	MIL-M-16576
	Phosphor bronze	MIL-N-894
		MIL-B-892

MIL-P-17639(SHIPS)

3.4.2 Class C-2 pumps.-

3.4.2.1 All pumps of this class shall be suitable for parallel operation and shall have constantly rising head-capacity characteristic curves. Each pump with a total head in excess of 100 p.s.i. shall have a characteristic curve such that at constant rated speed the total head at shut-off will be not less than 10 percent nor more than 20 percent above total head at rated capacity.

3.4.2.2 The preferred design for class C-2 pumps shall be single stage, double suction, volute type.

3.4.2.3 Materials for class C-2 pumps shall be in accordance with those for class C-1 pumps (see table I).

3.4.2.4 Each class C-2 pump with a total head of 100 p.s.i. or higher shall have a synthetic rubber O-ring seal between the casing wearing ring and the casing.

3.5 Drawings.-

3.5.1 Drawings shall be in accordance with type I of Specification MIL-D-963.

3.5.2 Outline drawings shall be furnished covering complete pump units including pump, driver, bedplate and attached accessories. Separate outline drawings shall be furnished for each contract or order and for each different pump unit on a contract or order.

3.5.3 Pump master drawings shall include sectional assembly, complete list of material and details of all parts. The sectional assembly and list of material with references to detail drawings should be on a single sheet; and details shall be on one or more additional sheets. Several details should be shown on each pump master drawing. Details of single pump parts on size A sheets, resulting in a multiplicity of drawing sheets, should be avoided.

3.5.4 Subassemblies furnished as repair parts in lieu of or in addition to individual repair parts shall be recorded on the related outline drawings by reference notes or as additional items on the "List of Material" of the sectional assembly drawing.

3.5.5 Drawings for drivers and associated equipment shall be in accordance with the specifications for those equipments.

3.5.6 The sectional assembly drawing shall show all assembly clearances.

3.5.7 Drawings submitted with bids are not required to be in master drawing format.

3.6 Instruction books.- Instruction books shall be in accordance with type C of Specification MIL-B-15071, unless otherwise specified in the contract or order. A separate instruction book shall be furnished for each different pump unit except in special cases when books covering more than one pump may be approved. Preliminary instruction books submitted for approval shall include all proposed sections complete.

MIL-P-17639(SHIPS)

3.7 Repair parts and tools. -

3.7.1. Onboard. - Onboard repair parts of the types and quantities shown in table II shall be furnished as required in the contract or order.

Table II - Onboard repair parts.

Name of part	Quantity per set
Ball or roller bearings Internal water lubricated bearings Coupling bushings, pins and other wearing parts Felt wiper rings or oil seals. Packing/ Mechanical seals	100 percent complete replacement for all installed units per vessel $L \times A = 20 \checkmark$
Sleeve bearings Pivoted segmental bearings Oversize impeller wearing rings Undersize casing wearing rings Diaphragm bushings Lubricating oil pumps complete with drive shafting and gears Oil pump gears or rotors Lantern rings Stuffing box throat bushings	One to 4 units per vessel - 100 percent replacement for one pump Over 4 units per vessel - 100 percent replacement for two pumps
Rotors, completely assembled, including shaft, impellers, standard size impeller and casing wearing rings, casing diaphragms and bushings, sleeves, keys, nuts, flinger, and complete coupling Diffusion vanes	100 percent replacement for one pump $2 \text{ sets} \times 2$

3.7.1.1 The pump rotor assembly for flexible coupled units shall be completely assembled ready for installation in the unit for which intended and shall include any nonrotating parts which can be installed only by removing some rotating part or parts of the pump rotor.

3.7.1.2 Pump rotor assemblies for motor-driven close-coupled pumps shall be furnished disassembled.

3.7.1.2.1 The quantities of individual repair parts shall not be reduced because of duplication of parts furnished to make the rotor assembly except that standard casing wearing rings shall not be required.

3.7.1.3 Impeller and casing wearing rings, (see table II) shall be machined oversize and undersize as applicable by at least 0.015 inch in order to permit finish machining as required for replacement aboard ship.

3.7.1.4 Tools. -

3.7.1.4.1 A complete set of special tools required for the maintenance and repair of the pump units shall be included in each set of onboard repair parts.

MIL-P-17839(SHIPS)

3.7.1.4.2 The special tools shall include the following, as applicable:

- (a) Complete set of special wrenches of forged steel with hardened jaws.
- (b) One impeller pulling tool.
- (c) One set of babbitting mandrels with collars, complete for renewing white metal of all bearings.
- (d) One set of ball bearing pulling tools.
- (e) Any other special tools necessary for the proper maintenance of the units in service.
- (f) Tools for gasoline service pumps, or other pumps for handling explosive fluids, shall be non-sparking and in accordance with Specification MIL-T-16243.

3.7.1.4.3 Tools which are available in the Catalog of Naval Material, General Stores Section, such as common wrenches and standard pullers, will not be required. Standard complete or limited sets of pullers or parts of puller sets in accordance with Specification GGG-P-781 shall be identified as to type and use in notes on the outline or section assembly drawings. Special tools shall be detailed, and included in the list of material.

3.7.1.5 Each box containing onboard repair parts shall contain a list entitled "List of onboard repair parts and tools". The list shall be in a format suitable for use on outline drawings and in the instruction books. It shall not be less than nominal 8-1/2 by 11 inches in size.

3.7.1.5.1 The format of the list shall include a heading and columns of data for the items listed. The heading shall include titles and applicable entries as follows:

Reproduced from drawing number _____
 Number of ships _____
 Application _____
 Contract number _____
 Manufacturer _____
 Quantities are for _____ units per ship
 The columns shall include:
 Piece number _____
 Name of part _____
 Quantity _____
 Drawing number _____
 Standard Navy stock number _____
 Additional columns may be used as applicable

3.7.1.5.2 The list shall be so treated as to be resistant to oil, water and fading.

3.7.2 Stock. - The selection, stock numbering and quantities of repair parts for stock shall be determined and processed in accordance with Specification MIL-R-15137.

3.7.2.1 The cognizant supply demand control point for repair parts for stock is Ships Parts Control Center, Mechanicsburg, Pennsylvania, unless otherwise specified in the contract or order.

3.8 Workmanship. - The equipment, including all parts and accessories, shall be manufactured and finished with first class workmanship in all respects.

4. SAMPLING, INSPECTION, AND TEST PROCEDURES

4.1 Qualification tests at a Government laboratory. - Qualification tests shall be conducted at the Engineering Experiment Station, Annapolis, Maryland. The head, capacity and other characteristics of units for qualification tests shall be as specified by the Bureau of Ships.

MLL-P-17639(SHIPS)

4.1.1 The qualification tests shall adequately demonstrate the ability of the pump to handle the specified capacities at the maximum specified temperature of the liquid and the minimum suction head or maximum suction lift or vacuum. Sufficient data shall be taken during the tests to prepare pump characteristic curves as required herein. Test data and curves shall be complete over the entire range of capacities from shut-off to as near free delivery as possible. The following test curves shall be prepared:

- (a) Capacity versus total head.
- (b) Capacity versus pump efficiency.
- (c) Capacity versus brake horsepower.

4.1.2 Endurance test. - The pump shall be operated for 24 hours continuous at a capacity as near free delivery as possible and for 12 hours at a capacity as near shut-off as possible. Failure of any part of the pump during the endurance test shall be considered as failure of the pump to qualify. The pump shall complete the endurance test without excessive noise, vibration or wear of parts.

4.1.3 Consideration will be given to granting qualification as a result of service tests. To be granted qualification as the result of service tests the following requirements shall be met:

- (a) Two or more pumps of the general design and general operating characteristics shall have given satisfactory service onboard a Naval vessel for a period of at least two years and must still be in service on such vessel at the time qualification is requested.
- (b) When the design of a pump in service for which a manufacturer requests qualification does not meet current Naval requirements as regards head and capacity characteristics, the manufacturer shall be required to furnish satisfactory evidence that he has produced pumps of a design, head and capacity characteristics equal to those currently required for Naval service. The Bureau of Ships reserves the right to require additional qualification tests of any design of pump, which, in its opinion, has been changed sufficiently to require further demonstration of its suitability.
- (c) Any manufacturer whose product has been eligible to be placed on the qualified products list as a result of service test shall be required on his first contract or order after being granted qualification to submit a complete unit to the Engineering Experiment Station for a check test which will consist of the qualification tests. The awarding of qualification shall be contingent upon the unit passing the check test.

4.1.4 Separate qualification tests shall be required on vertical and on horizontal units under each class, except that qualification on vertical design may be extended to cover horizontal design also. Tests on more than one unit of each mounting and class normally will not be required.

4.2 Shop tests. -

4.2.1 Pump casings shall be tested hydrostatically to a pressure one and one-half times the maximum discharge pressure or total head, whichever is greater, but in no case to less than 50 pounds per square inch gage.

4.2.2 Pumps for submarine systems which are subjected to sea pressure shall withstand a hydrostatic test pressure equal to one and one-half times the designed submergence pressure of the vessel plus one and one-half times the total head of the pump.

4.2.3 Each pump, except those driven by alternating current motors, shall be tested in the shop of the manufacturer or contractor at 25 percent above designed maximum operating speed by a continuous nonstop run of at least 30 minutes. This test shall be conducted in the presence of the Government inspector, who shall check operation and smoothness of running. While running at this speed the pump

MIL-P-17639(SHIPS)

need not be loaded except as necessary to prevent injury. For four-bearing units and for geared units, these tests may be conducted with or without the driving units and gear units, provided the driving units and gear units have already been independently tested in the same manner. For continuous or rigid coupled shaft sets, these tests shall be made with the driving units connected in place. In the case of pumps driven by alternating current motors each unit shall be tested for smoothness of operation at full load and full speed.

4.3 Performance acceptance tests. -

4.3.1 It shall be the responsibility of the prime contractor to insure that tests required on assembled units are made.

4.3.2 Driving units shall be tested as required by the applicable equipment specifications.

4.3.3 One pump of each type and size on contract or order, as selected by the Government inspector, complete, including the turbine and reduction gear, if used, or the motor and controller, shall be given a test to determine the overall power or steam consumption of the unit under the specified or guaranteed conditions. This test may be conducted in the shop of the main contractor or subcontractor as arranged with the bureau or agency concerned. The Bureau of Ships may consider waiver of overall power or steam consumption tests on pumps if identical units with identical guarantees have been previously tested.

4.3.4 For turbine driven pumps, the functioning of the speed governors shall be carefully observed during these tests, and all adjustments that may be necessary to insure satisfactory operation at all normal operating speeds shall be made before the units are accepted. The governors shall function as specified in the turbine specifications. When pressure regulating governors are specified, the foregoing requirements shall apply to this equipment also, and compliance with the governor specifications shall be demonstrated.

4.3.4.1 Performance acceptance tests shall ordinarily be conducted at the same time as, and shall include the inclined operation tests as specified for the driving unit. For inclined operation tests the unit shall be run at maximum operating speed, but need not be fully loaded.

4.3.5 Performance acceptance tests shall adequately demonstrate the ability of the pump to handle its rated capacity of specified liquid at the maximum temperature and minimum suction head or maximum suction lift or vacuum, as applicable.

4.3.6 Sufficient data shall be taken during the tests to prepare pump characteristic curves as specified in 4.3.7. In all cases the test data shall be corrected to the specified operating conditions as to steam pressure and temperature, exhaust pressure, voltage, frequency, temperatures, specific gravity, suction head or lift, and vacuum, as set forth in the contract or order; such conditions shall be clearly shown on the data sheets. The data sheets shall state the actual finished diameter of the pump impellers installed on test. Test data and curves shall be complete over the entire range of capacities from shut-off to as near free delivery as possible.

4.3.7 The following test curves shall be supplied for constant speeds of approximately 90, 100 and 110 percent of designed speed:

- (a) Capacity versus total head.
- (b) Capacity versus pump efficiency.
- (c) Capacity versus brake horsepower.
- (d) Capacity versus steam consumption or electrical horsepower input.

Where pumps are driven by constant or multispeed alternating current motors, the curves shall be obtained for the rated speed conditions of the motor in lieu of those noted above.

MIL-P-17639(SHIPS)

4.3.8 The bureau or agency concerned may, when requested, authorize separate tests of the driving unit including reduction gear, if used, and driven unit, at the plants of the different manufacturers, and will accept overall power and steam consumption results and characteristic curves computed from the results therefrom. This should not be construed in any way to release the primary contractor from an operating run on one completely assembled unit from each contract. This operating test shall be run with the unit fully loaded and shall demonstrate all requirements of the specifications as to thrust, governing, balance, and lubrication, at maximum speed.

4.3.9 Complete test reports, including test data on both pumps and driving units, shall be assembled and distributed as follows:

- (a) Three to the Bureau of Ships (to be forwarded via the cognizant inspector).
- (b) One for primary district inspection office.
- (c) One for branch inspection office (if any).
- (d) Two to each supervisor of shipbuilding (one for supervisor's files, the other for the shipbuilder).
- (e) One to the Commander of each ship building yard concerned, for Navy yard built ships, when specified in the contract or order.

4.3.10 One complete pumping unit of each type, design and size shall be subject to the high impact shock test specified in Specification MIL-S-901 as required by 3.3.15.

4.3.11 Equipment previously accepted will not be resubmitted for shock test except when evidence of low shock resistance develops in the units installed. The bureau or agency concerned will initiate action with the manufacturer for correction of deficiencies, and reserves the right to require shock tests at any time.

4.3.12 All pump units shall be shock tested with drivers unless otherwise approved by the bureau or agency concerned. Flexible coupled pumps shock tested with one driver will not be required to be shock tested again when supplied with a different driver. Prime movers are subject to shock tests in accordance with the applicable equipment specifications.

4.3.13 One pump of each manufacturer's type and each nominal size shall be subject to shock tests. Compliance with shock resistance requirements may be covered by test of a similar unit subject to bureau or agency concerned approval.

4.3.14 The pump unit shall be considered to have failed to pass the shock tests in the event of any of the following:

- (a) Breakage of any parts, including mounting bolts.
- (b) Appreciable distortion or dislocation of any part, such as shaft, mounting feet, bearings.
- (c) A mechanical unbalance of more than two times the amplitude of unbalance measured prior to tests at rated speed, or more than that permitted by the specifications for the driver.

4.3.15 Shock tests will be conducted at the manufacturer's plant. Where a manufacturer is unable to conduct these tests at his own plant, he may arrange to have them conducted at a commercial laboratory, or Government laboratory suitably equipped to conduct tests. Where shock tests are conducted at a Government laboratory, copies of the applicable master drawings shall accompany the units.

4.3.16 Pump units which have been subjected to the high-impact shock test and have failed to conform to the requirements will not be acceptable.

MIL-P-17639(SHIPS)

4.3.17 Pump units which have been subjected to the high-impact shock test and have successfully passed this test shall be considered acceptable for such service as the bureau or agency concerned may authorize. Such equipment will be returned by the Government to the contractor for reconditioning as follows:

- (a) Minor deformations of mounting flanges shall be corrected.
- (b) Minor deformations affecting alignment shall be corrected.
- (c) All bearings shall be replaced.
- (d) Each part shall be carefully examined by the contractor and any part which he considers substandard shall be replaced.

Minor deformations shall be defined as those which do not cause unqualified rejection of the design under high-impact shock test but which are in excess of the design dimensional tolerances specified on the applicable pump drawings.

4.4 Inspection of pump repair parts. - The pump repair parts required by 3.7.1 shall be inspected to assure interchangeability with the similar parts in the assembled pumps. Ordinarily material analyses and physical test specimens will not be required but the Government inspector shall employ such procedures as will assure the delivery of parts made of the same materials and by the same processes as for the assembled pumps.

4.5 Inspection procedures. - For Naval purchases, the general inspection procedures shall be in accordance with General Specifications for Inspection of Material.

5. PREPARATION FOR DELIVERY

5.1 Preservation, packaging, packing and marking. - Pumps shall be prepared for delivery for domestic shipment - immediate use; domestic shipment and storage; or for overseas shipment in accordance with Specification MIL-P-16789 (see 6.1).

5.2 Marking. - Nomenclature used in the marking of interior packages and shipping containers shall be the exact nomenclature for the part or item that has been approved under the contract or order.

6. NOTES

6.1 Ordering data. - Procurement documents should specify the following:

- (a) Title, number, and date of this specification.
- (b) Class required (see 1.2).
- (c) Rated capacity.
- (d) Rated total head.
- (e) Horizontal or vertical installation (see 3.3.2.1).
- (f) Liquid handled.
- (g) Specific gravity of liquid handled.
- (h) Liquid temperature.
- (i) Suction head.
- (j) Type drive.
- (k) Electrical characteristics (for motor drive) as required by applicable motor and controller specifications.
- (l) Turbine characteristics (for turbine drive):
 - (1) Type connection to driven unit.
 - (2) Steam conditions (pressure and temperature) at the throttle (see the specification for pump pressure regulating governors regarding pressure drop through such governors), also the maximum designed boiler steam drum pressure of the installation for which the turbine is intended.
 - (3) Exhaust conditions (pressure or vacuum) at turbine exhaust.

MIL-P-17639(SHIPS)

- (m) Internal combustion engine characteristics (for engine drive):
 - (1) Type engine.
 - (2) Starting equipment required.
 - (3) Type of sea water pumps.
 - (4) Whether overspeed governor should be furnished and type requested.
- (n) Whether shipment is for domestic shipment - immediate use; domestic shipment and storage; or for overseas shipment (see 5.1).
- (o) If repair parts boxes are required, specify type (metal or wood) (see 5.1).
- (p) That the following data is required with bids:
 - (1) Sectional assembly drawing of pump.
 - (2) A drawing of the unit showing overall dimensions.
 - (3) Pump characteristic curves.
 - (4) Pump efficiency at rated capacity.
 - (5) Horsepower of driver.
 - (6) RPM at rated capacity.
 - (7) Weight of complete unit.
 - (8) The manufacturer and descriptive data of the driven and associated accessories, such as controller.
- (q) The number of pumps per vessel on which quantity of onboard repair parts is to be based.

6.2 In the procurement of products requiring qualification, the right is reserved to reject bids on products that have not been subjected to the required tests and found satisfactory for inclusion on the Military Qualified Products List. The attention of suppliers is called to this requirement, and manufacturers are urged to communicate with the Bureau of Ships, Navy Department, Washington 25, D. C., and arrange to have the products that they propose to offer to the Army, the Navy or the Air Force, tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. Information pertaining to qualification of products covered by this specification may be obtained from the Chief of the Bureau of Ships, Navy Department, Washington 25, D. C.

6.3 This specification supersedes that part of Section S47-2 of the General Specifications for Machinery covering class C-1 and class C-2.

Notice.- When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data, is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

Custodian:
Navy - Bureau of Ships

MIL-P-17840(SHIPS)
1 March 1954

MILITARY SPECIFICATION
PUMP, CENTRIFUGAL, CLOSE-COUPLED, NAVY STANDARD

1. SCOPE

1.1 This specification covers electric motor driven Navy standard close coupled, single stage, centrifugal pumps. It is the intention of this specification that pumps of a given capacity in gallons per minute and total dynamic head in feet and type of electrical voltage from all sources of supply be interchangeable as to mounting dimensions, size and location of piping connections, shaft extension, shaft sleeve, and flinger as outlined in this specification.

2. APPLICABLE DOCUMENTS

2.1 The following specifications, standards, drawings, and publications, of the issue in effect on date of invitation for bids, form a part of this specification:

SPECIFICATIONS

FEDERAL

GGG-P-781 - Pullers, Bushing, Bearing, Gear, Wheel Hub and Cylinder Sleeve, Installing and Removing.

MILITARY

- MIL-S-854 - Steel, Corrosion Resisting: Plates, Sheets, Strips, and Structural Shapes.
- MIL-B-892 - Bronze, Phosphor, Rolled or Drawn, Bars, Plates, Rods, Shapes, Sheets and Strips.
- MIL-N-894 - Nickel-Copper Alloy, Wrought.
- MIL-S-901 - Shockproof-Equipment, Class HI (High Input), Shipboard Application, Tests for.
- MIL-D-963 - Drawings, Production (for Electrical and Mechanical Equipment for Naval Shipboard Use).
- MIL-B-994 - Brass, Naval, Wrought.
- MIL-C-2174 - Controllers and Master Switches, Direct-Current (Naval Shipboard Use).
- MIL-C-2212 - Controllers and Master Switches, Alternating-Current (Naval Shipboard Use).
- MIL-I-15024 - Identification Plates, Information Plates and Marking Information for Identification of Electrical, Electronic and Mechanical Equipment.
- MIL-B-15071 - Book, Instruction, Preparation, Contents, and Approval.
- MIL-R-15137 - Repair Parts for Electrical and Mechanical Equipment (Naval Shipboard Use).
- MIL-B-15939 - Bronze, Aluminum, Wrought.
- MIL-B-16261 - Bronze, Bearings: Castings.
- MIL-P-16298 - Preservation, Packaging, Packing, and Marking of Electric Machines Having Rotating Parts (Includes Associated Repair Parts).
- MIL-B-16541 - Bronze, Valve: Castings.
- MIL-M-16576 - Metal, Gun: Castings.
- MIL-P-16789 - Preservation, Packaging, Packing, and Marking of Pumps General and Associated Repair Parts.
- MIL-M-17059 - Motors, Alternating Current, Fractional HP (Shipboard Use).
- MIL-M-17080 - Motors, Alternating Current, Integral HP (Shipboard Use).
- MIL-P-17303 - Packing Material, Plastic Metallic and Nonmetallic.

1954
BUFFALO PUMPS, INC.

GPO-O-NAV-L-347

**DEFENDENT'S
EXHIBIT**
Buffalo Pumps

MIL-P-17840(SHIPS)

MILITARY (cont'd.)

- MIL-M-17413 - Motors, Direct-Current Integral HP (Shipboard Use).
- MIL-A-17472 - Asbestos Sheet Compressed (Packing Material).
- MIL-N-17508 - Nickel-Copper-Aluminum Alloy, Wrought.
- MIL-M-17558 - Motor, Direct-Current, Fractional HP (Shipboard Use).
- MIL-C-17588 - Cloth, Billiard.
- MIL-P-17839 - Pumps, Centrifugal, Miscellaneous Service, for Use on Naval Ships.
- MIL-N-20164 - Nickel, Copper, Alloy, Castings.

NAVY DEPARTMENT

- General Specifications for Inspection of Material.
- General Specifications for Machinery:
 - S1-3 - Bolts, Bolt-Studs, Stud-Bolts, Studs, Screws and Nuts.
 - S1-4 - Welding and Allied Processes.
- General Specifications for Building Vessels of the United States Navy.
- Appendix 6 - Instructions for Painting.
- 46B15 - Bronze, Manganese, Wrought; Bars, Forgings, Plates, Rods, Shapes, Sheets and Strips.

STANDARDS

MILITARY

- MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.

DRAWINGS

BUREAU OF SHIPS

- B-104 - Flanged Composition Pipe Fittings, 100 P.S.I. and Below 425° F.
- B-178 - Composition Silver Brazing Flanges for Copper and Copper-Nickel Alloy Tubing and Brazed Pipes.
- B-214 - Root Connections for Attaching Piping.
- 5000-S4800-3000 - Piping Schedule, Pipe Fittings, Valves, and Types of Joints Used in Piping Systems.

PUBLICATIONS

BUREAU OF SHIPS

- NAVSHIPS 250-357-1 - Conditions Governing Tests in Naval Laboratories.

(Copies of specifications, standards, drawings, and publications required by contractors in connection with specific procurement functions should be obtained from the procuring agency or as directed by the contracting officer.)

2.2 Other publications.- The following document forms a part of this specification. Unless otherwise indicated the issue in effect on date of invitation for bids shall apply.

NATIONAL BUREAU OF STANDARDS PUBLICATION

- Handbook H-28 - Screw Thread Standards for Federal Services.

(Copies of Handbook H-28 may be obtained upon application, accompanied by money order, coupon, or cash, to the Superintendent of Documents, Government Printing Office, Washington 25, D. C.)

3. REQUIREMENTS

3.1 Qualifications.- The pumping equipment furnished under this specification shall be a product which has been tested and has passed the qualification tests specified herein (see 6.2).

MIL-P-17840(SHIPS)

3.2 Materials.-

3.2.1 Materials of construction of the pump parts, unless otherwise specified herein, shall conform to the minimum requirements of table I.

3.2.2 Where no specifications are specified herein for the material for certain parts, the material used shall be of a type and quality consistent with that specified for associated parts in the pump. The use or substitution of manufacturer's material shall be subject to approval by the bureau or agency concerned and shall be clearly indicated in the list submitted with the master drawings.

Table I - List of material.

Name of part	Material	Material specification
Casings	Gun metal, or Valve bronze	MIL-M-16576 MIL-B-16541
Impeller	Gun metal	MIL-M-16576
Impeller key	Nickel-copper alloy	MIL-S-854
Shaft sleeve	Nickel-copper-aluminum alloy Minimum hardness 285 Brinell	MIL-N-17506
Flinger	Gun metal or Valve bronze	MIL-M-16576 MIL-B-16541
Wearing rings (see 3.12)	Bearing bronze, grade II, or grade III, or Nickel-copper alloy, or Valve bronze	MIL-B-16261 MIL-N-894, or MIL-N-20164 MIL-B-16541
Impeller nut	Gun metal, or Nickel copper alloy, or Phosphor bronze	MIL-M-16576 MIL-N-894 MIL-B-892
Glands	Gun metal, or Valve bronze	MIL-M-16576 MIL-B-16541
Lantern ring	Valve bronze	MIL-B-16541
Throat bushing	Bearing bronze, or Valve bronze	MIL-B-16261 MIL-B-16541
Mounting bracket	Gun metal, or Valve bronze	MIL-M-16576 MIL-B-16541
Studs, bolts, and nuts	Nickel-copper alloy, or Naval brass, or Manganese bronze	MIL-N-894 MIL-B-994 46B15
Stuffing box packing	Plastic metallic, lead base	MIL-P-17303 symbol 1433
Surface packing	Asbestos, sheet, compressed	MIL-A-17472 symbol 2150

MIL-P-17840(SHIPS)

3.3 General design.-

3.3.1 The principle of reliability is paramount and no compromise to this principle shall be made with any basic requirements of the design. It is the intention of this specification to obtain close coupled centrifugal pumps that will operate for long periods of time with a minimum of servicing. Where wear or erosion is unavoidable, the parts subjected to such wear or erosion shall be of the best materials available for the purpose in order to reduce these detrimental effects to a minimum. The design and construction of all pumps shall be compact as set forth in figure 1 consistent with following requirements:

- (a) Reliability
- (b) Accessibility for repair
- (c) Resistance to wear or corrosion
- (d) Economy
- (e) Satisfactory operation when inclined as follows:
 - (1) Up to 5 degrees from the normal horizontal position in the fore and aft plane (permanently inclined).
 - (2) Up to 15 degrees to either side (permanently inclined).
 - (3) With the vessel rolling up to 45 degrees from the vertical to either side.
 - (4) With the vessel pitching 10 degrees up and down from the normal horizontal plane.

3.3.2 The design of the pump units shall be sufficiently rigid to permit handling, shipment and installation of the units onboard ship without disturbing alignment; and such that the normal distortion, weaving or vibration of the supporting structures onboard ships cannot cause fracture or appreciable distortion.

3.3.3 Special attention shall be given the design to insure that leakage from the pump stuffing box glands cannot enter motor frames or bearing brackets.

3.3.4 Sufficient clearance shall be provided around bolt heads and nuts to permit the use of ordinary tools.

3.4 Installation. - All pumps will be normally installed to operate in horizontal position; however, all pumps shall be capable of operation in a vertical position with the motor above the pump.

3.5 Mounting.-

3.5.1 Dimensions. - All pumps shall have mounting dimensions and location of piping connections as shown on figure 1.

3.5.2 Brackets. - Mounting bracket shall contain a drip pocket for the collection of leakage from the stuffing box. Size of the tapped holes shall be as shown on figure 1.

MIL-P-17840(SHIPS)

3.6 Size of radial and thrust ball bearings. - The size of the radial and thrust ball bearings for each size motor frame shall be as specified in tables IX and X of figures 2 and 3. Hydraulic unbalance due to use of single inlet impellers without balancing rings, shall not exceed the values specified for bearings in table II, when computed according to the following formula:

$$T = P (A_1 - A_0) + .05 P (A_2 - A_1)$$

When:

T = Maximum unbalanced thrust in pounds.

P = Pressures in pounds per square inch (gage) at shut-off.

A₂ = Area of impeller at radius R₂ in square inches.

A₁ = Area of impeller to outside of impeller-wearing ring, radius R₁ in square inches.

A₀ = Area in square inches to outside of shaft sleeve, radius R₀ (see figure 4).

Table II - Permissible thrust loads.

Navy Department bearing No.	Revolutions per minute			
	1150	1750	2800	3500
305 - Z	---	215	---	180
306 - Z	---	280	---	215
307 - Z	---	235	---	255
308 - Z	---	400	---	300
309 - Z	560	470	375	350
310 - Z	600	500	400	360
312 - Z	700	590	470	425
313 - Z	600	670	530	495

3.7 Piping and valves. - All valves, flanges and fittings for pipe connections shall conform to Drawing 5000-S4200-3000.

3.8 Alternating current and direct current motors. -

3.8.1 The standardized frame numbers for the various ratings of close-coupled pump motors shall be as specified in tables III and IV. Frame flange and shaft extension dimensions shall be as shown on figures 2 and 3 as applicable.

MIL-P-17840 (SHIPS)

TABLE III
AC MOTORS
50°C AMBIENT, CLASS B INSULATION (OR CLASS H INSULATION,
CLASS B TEMPERATURE LIMITS) WHERE ADVANTAGEOUS.

FRAME NO.	CONSTANT SPEED						MULTISPEED VARIABLE TORQUE	
	3500 RPM HP ENCL	1750 RPM HP ENCL	1150 RPM HP ENCL	1750/875 RPM HP ENCL	1150/575 RPM HP ENCL			
17 NC		1/3 SPT						
18 NC	1/2, 3/4 SPT	1/2 SPT						
203 NC		3/4, 1 SPT						
204 NC	1 SPT							
224 NC	1 1/2, 2, 3 SPT	2 SPT						
225 NC	5 SPT	3 SPT						
254 NC	7 1/2 SPT	5 SPT						
284 NC		7 1/2 SPT	5 SPT					
324 NC	10 TE		7 1/2 TE	7.5/1.9 TE				
326 NC	15 TE	10 TE		10/2.5 TE	7.5/1.9 TE			
364 NC		15 TE	10 TE	15/3.7 TE	10/2.5 TE			
365 NC	20 TE	20 TE	15 TE	20/5 TE	15/3.7 TE			
404 NC	25, 30 TE	25 TE	20 TE	25/6.2 TE				
405 NC	40 TE		25 TE					
444 NC								
445 NC								
504 NC								
505 NC								
404 NCI					20/5 TE			
405 NCI					25/6.2 TE			
444 NCI								
445 NCI								

TE - TOTALLY ENCLOSED, SPT - SPRAYTIGHT, TE & SPT MOTORS MAY BE FAN COOLED

7

MIL-P-17840(SHIPS)

3.8.2 Anti-friction bearings shall be radial type, single row, single shielded, Conrad type assembly or single row ball, double row width double seal, prelubricated. The sizes used for the various frames shall conform to the requirements of tables IX and X of figures 2 and 3.

3.8.3 Shafts shall be of nickel-copper alloy in accordance with Specification MIL-N-894.

3.8.4 Alternating current motors. -

3.8.4.1 Alternating current motors shall be in accordance with Specification MIL-M-17059 or MIL-M-17060, except as otherwise specified herein, and shall conform to the following classification requirements:

Service	Navy A.
Ambient temperature	50°C.
Duty	Continuous.
Classification	Squirrel cage induction.
Sub-classification	Design B. Multi-speed motors shall be variable torque.
Bearings	Ball (see tables IX and X of figures 2 and 3).
Insulation	Class A, B, or K.
Number of phases	Three.
Frequency	60 cycles.
Voltage	440 volts.

3.8.4.2 Sizes, degree of enclosure and speed characteristics shall be in accordance with table III and, when a choice exists, will be specified (see 6.1).

3.8.5 Direct current motors. -

3.8.5.1 Direct current motors shall be in accordance with Specification MIL-M-17413 or MIL-M-17556, except as otherwise specified herein, and shall conform to the following classification requirements:

Service	Navy A.
Ambient temperature	50°C.
Duty	Continuous.
Voltage	115 or 230 volts as specified in contract or order.
Winding	Shunt.
Bearings	Ball (see tables IX and X of figures 2 and 3).
Insulation	Class A or B

3.8.5.2 Sizes, degree of enclosure and speed characteristics shall be in accordance with table IV and, when a choice exists, will be specified (see 6.1).

3.8.5.3 Adjustable speed motors. - Minus 15 percent and minus 50 percent adjustable speed motors shall be adjustable from 15 percent and 50 percent less than rated speed respectively to rated speed by field control. Full rated power output shall be obtained at rated (high) speed.

3.8.5.4 Speed tolerance. - The full load speed of direct current constant speed motors at operating temperature shall be not less than 98 percent nor more than 103 percent of the specified speed for integral horsepower motors, and not less than 97 percent nor more than 108 percent of the specified speed for fractional horsepower motors.

3.9 Controllers. - All motor controllers shall be of the characteristics specified (see 6.1) and shall conform to Specification MIL-C-2174 for direct current controllers or Specification MIL-C-2212 for alternating current controllers.

MIL-P-17840(SHIPS)

3.10 Shockproofness.-

3.10.1 The design of all complete pumping units shall be such that they are capable of passing the class III (high-impact) shock test specified in Specification MIL-S-901.

3.10.2 Shockmounts shall not be used unless bureau or agency approval of the mount and its proposed application is given.

3.10.3 The determination of stresses resulting from the shock tests is accomplished by the application of the usual methods of analytical mechanics. The allowable stress in components due to shock shall be the yield strength (0.2 percent offset) of the material. Normal stresses in parts, such as the tensile stress in a bolt due to initial pull-up, shall not be added to the shock stresses. It is of paramount importance that the maximum accelerations possible under the shock tests be utilized in the design of holding down bolts, supporting feet or lugs, and main structural members of the equipment, and that no failure or permanent deformation occurs as a result of shock.

3.11 Casings.-

3.11.1 The design of casings shall be sufficiently rugged to withstand without fracture or appreciable distortion the strains to which they may be subjected.

3.11.2 Casings shall be so designed as to permit the inspection and replacement of wearing parts. Suction covers shall be removable to permit removal of the impeller and other wearing parts for pump without dismounting the unit.

3.11.3 All pump casings for a specific pump number and manufacture shall be completely interchangeable regardless of pump capacity.

3.11.4 All casings shall have flanged suction and discharge connections. All flanges shall be in accordance with Drawing B-176.

3.11.5 All pumps shall have casings arranged so that the discharge can be located in any of the three positions shown on figure 1.

3.11.6 All casings shall be provided with the necessary tapped vent, drain, priming, and gauge connections for the three positions of discharge. Bosses for gage connections shall be of sufficient size for conversion to flanged connections in accordance with Drawing E-214.

3.11.7 All casings shall be provided with vent cocks in the proper location for the position of discharge.

3.11.8 All casings shall be arranged with stuffing boxes of the dimension indicated for the outside diameter of the stuffing box packing rings as shown on figure 5.

3.11.9 Hydrostatic pressure.- Casings shall be designed to withstand the applicable hydrostatic pressure specified on figure 1 (see 4.1.1).

3.12 Impellers and wearing rings.-

3.12.1 All impellers shall be of the single inlet enclosed type. Outside surfaces of impellers shall be smooth finished. Inside surfaces shall be file finished insofar as practical. All impellers shall be dynamically balanced.

3.12.2 Impeller wearing rings may be omitted on pumps 1 through 6 inclusive and also pumps 14 and 15 (see table V).

3.12.3 A wearing ring and its opposing surface shall be of dissimilar material.

MIL-P-17840(SHIPS)

3.12.4 Impeller nuts shall be of the self-locking acorn type.

3.12.5 The impeller shall have the approximate maximum diameter for each pump as specified in table V.

Table V - Approximate maximum impeller diameter.

Pump number	Approximate maximum impeller diameter	Pump number	Approximate maximum impeller diameter
	Inches		Inches
1	5	10	7-1/2
2	6-3/4	11	9
3	5	12	9-3/4
4	6-1/4	13	10-1/2
5	5-1/8	14	8
6	7	15	5-1/4
7	10	16	9
8	9-1/4	17	10-1/2
9	9-1/4		

3.13 Shaft sleeves. - Shaft sleeves shall be in accordance with figure 5.

3.14 Flingers. - Flingers shall be in accordance with figure 6.

3.15 Stuffing boxes. -

3.15.1 Stuffing boxes shall be of adequate depth of design to reduce leakage to a minimum under all operating conditions.

3.15.2 All casings shall be fitted with throat bushings and lantern rings. Special care shall be taken in the design to insure that compression of the inner packing will not allow the lantern ring to move sufficiently to cut off or restrict the sealing water supply.

3.15.3 Sealing liquid connections and lines to the lantern ring from pump casings shall be provided. Lantern rings shall be solid or split in halves with the halves secured together in a manner to form solid rings for setting up.

3.15.4 Stuffing box gland shall be split to facilitate packing the stuffing box. Gland halves shall be secured in a manner approved by the bureau or agency concerned. Glands shall be set-up by nuts threaded on studs or swing bolts screwed in the casing.

3.16 Threaded parts. - All threaded parts such as bolts, studs and nuts shall conform to Section S1-3 of the General Specifications for Machinery and Handbook H-28.

3.17 Welding shall be in accordance with Section S1-4 of General Specifications for Machinery.

MIL-P-17840(SHIPS)

3.18 Identification plates.-

3.18.1 Identification plates shall be furnished on each pump and shall be type A or B in accordance with Specification MIL-I-15024, except that identification plates of plastic or aluminum are not acceptable.

3.18.2 Identification plates shall be secured to equipment with corrosion resistant metallic screws.

3.18.3 Pump identification plates shall contain data as follows:

- (a) Manufacturer's name.
- (b) Manufacturer's model or type and size.
- (c) Service application.
- (d) Manufacturer's serial number.
- (e) Salient design characteristics:
 - (1) Capacity in gallons per minute.
 - (2) Total head in pounds per square inch.
 - (3) Speed of shaft in revolutions per minute.
 - (4) Brake horsepower.
 - (5) Test pressure.
 - (6) Special data vital to the unit:
 - (a) Suction pressure.
 - (b) Submergence.
 - (c) Impeller diameter.
 - (d) Contract number (and item number for multiple unit orders).
 - (e) Bureau of Ships stock number.
 - (f) Section for inspector's stamp.
 - (g) Navy standard pump number.

3.18.4 Each driving unit and each accessory unit shall have an identification plate in accordance with the applicable equipment specification.

3.19 Painting.- Painting shall be in accordance with Appendix 6 of General Specifications for Building Vessels of the United States Navy.

3.20 Pumps for a specific application shall be selected and specified from rating chart figure 7 for alternating current motors, or figure 8 for direct current motors. Bidders shall quote on the standardized pump size and with the horsepower and speed motor as indicated on rating chart for the application.

3.21 Pumps for all services shall have constantly rising head-capacity curves from maximum or wide open capacity to zero or shut-off capacity. Pumps for ship's fresh water service rated at 70 g. p. m. and above shall have a constantly rising head-capacity curve from rated point to shut-off such that at one-third of rated capacity the head shall not be less than 10 pounds per square inch above rated head. At 3 pounds per square inch below rated head and 20 feet dynamic suction lift, operation shall be stable and within the breaking-off point on the head-capacity curve. Ship's fresh water pumps below 70 g. p. m. rated capacity shall have a shut-off head not less than 10 pounds per square inch above rated head and shall operate satisfactorily over a range of 8 pounds per square inch above to 5 pounds per square inch below rated head.

3.22 All pumps shall be designed for satisfactory operation at a minimum dynamic suction lift of 15 feet of water at 85°F.

3.23 All pumps units shall have nonoverloading horsepower characteristics.

3.24 Rotation.- All pumps shall be right hand rotation (clockwise when viewed from motor end of unit) only.

3.25 Casing wearing rings shall be fitted in all pumps.

MIL-P-17840(SHIPS)

3.26 Pump casing joints shall be made up using compressed asbestos sheet gaskets.

3.27 Drawings.-

3.27.1 Drawings shall be in accordance with type I of Specification MIL-D-963.

3.27.2 Outline drawings shall be furnished covering complete pump units including pump, driver and accessories. Separate outline drawings shall be furnished for each contract or order and for each different pump unit on a contract or order.

3.27.3 Pump master drawings shall include sectional assembly, complete list of material and details of all parts. The sectional assembly and list of material with references to detail drawings shall be on a single sheet; and details shall be on one or more additional sheets. Several details should be shown on each pump master drawing. The width of drawings shall be 28 inches.

3.27.4 Subassemblies furnished as repair parts in lieu of or in addition to individual repair parts shall be recorded on the related outline drawings by reference notes or as additional items on the "List of Material" of the sectional assembly drawing.

3.27.5 All pump outline and master drawings shall include in the title block the designation "Navy standard close-coupled pump number" followed by the applicable pump number.

3.27.6 Final approved sectional assembly drawings shall include characteristic curves for each impeller used covering various impeller diameters from the smallest to the largest applicable.

3.27.7 Drawings for drivers and associated equipment shall be in accordance with the applicable specifications.

3.27.8 The sectional assembly drawing shall show all assembly clearances.

3.27.9 Drawings submitted with bids are not required to be in master drawing format.

3.28 Instruction books.- Instruction books shall be in accordance with type C of Specification MIL-B-15071, unless otherwise specified in the contract or order. A separate instruction book shall be furnished for each different pump unit except in special cases when books covering more than one pump may be approved by the bureau or agency concerned. Preliminary instruction books submitted for approval shall include all proposed sections complete.

3.29 Repair parts.-

3.29.1 Onboard.- Onboard repair parts shall consist of pump, motor, and controller parts and tools as required by the applicable equipment specifications. A rotor or armature shall be included in each set of onboard repair parts.

3.29.1.1 Pump repair parts and tools.-

3.29.1.1.1 The number of sets of pump repair parts and tools to be furnished shall be as specified (see 6.1). The following parts shall constitute one set:

- 1 - Impeller
- 1 - Impeller nut or impeller locking assembly
- 1 - Shaft sleeve
- 1 - Lantern ring
- 1 - Throat bushing
- 1 set - Stuffing box packing
- 1 - Flinger

MIL-P-17840(SHIPS)

- 1 set - Casing wearing rings - undersize (0.015 inch min.)
- 1 set - Impeller wearing rings - regular
- 1 set - Impeller wearing rings - oversize (0.015 inch min.)
- 1 set - Mounting screws for each ring furnished:
 - 1 - Impeller puller
 - 1 - Sleeve puller

3.29.1.1.2 The number of repair parts and tool sets per vessel shall be established on the following basis:

Number of similar pumps per vessel	Number of pump spares and tool sets per vessel
1 to 3	1
4 to 6	2
7 to 10	3

Note. - Similar pumps are those for which all onboard pump parts are interchangeable.

3.29.1.2 Motor and controller repair parts shall be furnished in accordance with the applicable equipment specifications.

3.29.1.3 Tools which are available in the catalog of Naval Material, General Stores Section, such as common wrenches and standard pullers, will not be required. Standard complete or limited sets of pullers or parts of puller sets in accordance with Specification GGG-P-781 shall be identified as to type and use in notes on the outline or section assembly drawings. Special tools shall be detailed and included in the list of material. The water flingers may be used with pullers for removal of the shaft sleeves.

3.29.1.4 Each box containing onboard repair parts shall contain a list entitled "List of onboard repair parts and tools". The list shall be in a format for use on outline drawings and in the instruction books. It shall not be less than nominal 8-1/2 by 11 inches in size.

3.29.1.4.1 The format of the list shall include a heading and columns of data for the items listed. The heading shall include titles and applicable entries as follows:

Reproduced from drawing number _____
 Number of ships _____
 Application _____
 Contract number _____
 Manufacturer _____
 Quantities are for _____ units per ship
 The columns shall include:
 Piece number _____
 Name of part _____
 Quantity _____
 Drawing number _____
 Standard Navy stock number _____
 Additional columns may be used as applicable

3.29.1.4.2 The list shall be so treated as to be resistant to oil, water and fading.

3.29.2. Stock. - The selection, stock numbering and quantities of repair parts for stock shall be determined and processed in accordance with Specification MIL-R-15137.

MIL-P-17840(SHIPS)

3.29.2.1 The cognizant supply demand control point for repair parts for stock is Ships Parts Control Center, Mechanicsburg, Pennsylvania, unless otherwise specified in the contract or order.

3.30 Workmanship.- The equipment, including all parts and accessories, shall be manufactured and finished with first class workmanship in all respects.

4. QUALITY ASSURANCE PROVISIONS

4.1 Shop tests.-

4.1.1 All pump casings shall be tested hydrostatically at the pressure indicated for the pump shown on figure 1.

4.1.2 Each pump shall be tested in the shop of the manufacturer or contractor by a continuous non-stop run of at least 30 minutes. This test shall be conducted in the presence of the Government inspector, who shall check operation and smoothness of running at full load and full speed.

4.2 Performance acceptance tests.-

4.2.1 One pump of each size on contract or order, as selected by the Government inspector shall be given performance acceptance tests.

4.2.2 The unit shall be given a test to determine the overall power consumption under the specified or guaranteed conditions. This test may be conducted in the shop of the main contractor or subcontractor as arranged with the bureau or agency concerned. The bureau or agency concerned may consider the waiver of overall power consumption tests on pumps where identical units with identical guarantees have been previously tested.

4.2.3 Performance acceptance tests shall adequately demonstrate the ability of the pump to handle its rated capacity of specified liquid at the maximum temperature and minimum suction head or maximum suction lift or vacuum.

4.2.4 Sufficient data shall be taken during the tests to prepare pump characteristic curves as required herein. In all cases the test data shall be corrected to the specified operating conditions as to voltage, frequency, temperature, specific gravity, suction head or lift, and vacuum, as specified (see 6.1), such conditions shall be clearly shown on the data sheets. The data sheets shall state the actual finished diameter of the pump impellers installed on test. Test data and curves shall be complete over the entire range of capacities from shut-off to as near free delivery as possible.

4.2.5 The following test curves shall be supplied for the rated speed conditions of the motor.

- (a) Capacity versus total head.
- (b) Capacity versus pump efficiency.
- (c) Capacity versus brake horsepower.
- (d) Capacity versus electrical horsepower input.

4.2.6 Complete test reports including test data on both pump and driving units shall be assembled and distributed as follows:

- (a) Three to the Bureau of Ships (to be forwarded via the cognizant inspector).
- (b) One for primary district inspection office.
- (c) One for branch inspection office (if any).
- (d) Two to each Supervisor of Shipbuilding (one for Supervisor's files, the other for the shipbuilder) when specified in contract or order.
- (e) One to each vessel concerned (to be forwarded via the Supervisor of Shipbuilding or Commandant of the building yard) when specified in contract or order.
- (f) One to the Commandant for each building yard concerned, for Navy yard built vessels when specified in the contract or order.

MIL-P-17840(SHIPS)

4.2.7 The first pump of each size shall also be given extensive tests using dynamometer or calibrated motor to produce the following curves:

- (a) Gallons per minute versus total dynamic head at constant rated r. p. m. for various impeller diameters with superimposed constant efficiency and constant brake horsepower curves at 1.00 specific gravity.
- (b) Determination of the maximum suction lift in feet versus gallons per minute for each impeller diameter tested.

4.2.7.1 Two sets of data and curves based on the additional tests, including description of the test set-up, shall be forwarded directly to the bureau or agency concerned via the Government inspector and shall not be included as a part of the regular performance acceptance tests.

4.2.8 One complete pumping unit of each type, design and size shall be subject to the high impact shock test specified in Specification MIL-S-901.

4.2.9 Equipment previously accepted will not be resubmitted for shock test except when evidence of low shock resistance develops in the units installed. The bureau or agency concerned will initiate action with the manufacturer for correction of deficiencies, and may require shock tests at any time.

4.2.10 All pump units shall be shock tested with drivers unless otherwise approved by the bureau or agency concerned. Prime movers are subject to shock tests in accordance with the applicable equipment specifications.

4.2.11 One pump of each manufacturer's type and each nominal size shall be subjected to shock tests. Compliance with shock resistance requirements may be covered by test of a similar unit subject to approval by the bureau or agency concerned.

4.2.12 The pump unit shall be considered to have failed to pass the shock tests in the event of any of the following:

- (a) Breakage of any parts, including mounting bolts.
- (b) Appreciable distortion or dislocation of any part, such as shaft, mounting feet, bearings.
- (c) A mechanical unbalance of more than two times the amplitude of unbalance measured prior to tests at rated speed, or more than that permitted by the specifications for the driver.

4.2.13 Shock tests shall be conducted at the manufacturer's plant. Where a manufacturer is unable to conduct these tests at his own plant, he may arrange to have them conducted at a commercial laboratory, or Government laboratory equipped to conduct tests. Where shock tests are conducted at a Government laboratory, copies of the applicable master drawings shall accompany the units.

4.2.14 Pump units which have been subjected to the high-impact shock test and have failed to conform to the requirements will not be acceptable.

4.2.15 Pump units which have been subjected to the high-impact shock test and have successfully passed this test shall be considered acceptable for such service as the bureau or agency concerned may authorize. Such equipment will be returned by the Government to the contractor for reconditioning as follows:

- (a) Minor deformations of mounting flanges shall be corrected.
- (b) Minor deformations affecting alignment shall be corrected.
- (c) All bearings shall be replaced.
- (d) Each part shall be carefully examined by the contractor and any part which he considers substandard shall be replaced. Minor deformations shall be defined as those which do not cause unqualified rejection of the design under high-impact shock test but which are in excess of the design dimensional tolerances specified on the applicable pump drawings.

MIL-P-17840(SHIPS)

4.3 Inspection of pump repair parts. - The pump repair parts specified in 3.29 shall be inspected to assure interchangeability with the similar parts in the assembled pumps. Ordinarily material analyses and physical test specimens will not be required but the Government inspector shall employ such procedures as will assure the delivery of parts made of the same materials and by the same processes as for the assembled pumps.

4.4 Qualification tests at a Government laboratory. - Qualification tests shall be conducted at the Engineering Experiment Station, Annapolis, Maryland. The head, capacity and other characteristics of units for qualification tests shall be as specified by the Bureau of Ships. Conditions governing tests shall be as specified in Publication NAVSHIPS 250-357-1.

4.4.1 The qualification tests shall adequately demonstrate the ability of the pump to handle the specified capacities at the maximum specified temperature of the liquid and the minimum suction head or maximum suction lift or vacuum. Sufficient data shall be taken during the tests to prepare pump characteristic curves as required herein. Test data and curves shall be complete over the entire range of capacities from shut-off to as near free delivery as possible. The following test curves shall be prepared:

- (a) Capacity versus total head.
- (b) Capacity versus pump efficiency.
- (c) Capacity versus brake horsepower.

4.4.2 Endurance test. - The pump shall be operated for 24 hours continuous at a capacity as near free delivery as possible and for 12 hours at a capacity as near shut-off as possible. Failure of any part of the pump during the endurance test shall be considered as failure of the pump to qualify. The pump shall complete the endurance test without excessive noise, vibration or wear of parts.

4.4.3 Consideration will be given to granting qualification as a result of service tests. To be granted qualification as the result of service tests the following requirements shall be met:

- (a) Two or more pumps of the general design and general operating characteristics shall have given satisfactory service onboard a Naval vessel for a period of at least two years and must still be in service on such vessel at the time qualification is requested.
- (b) When the design of a pump in service for which a manufacturer requests qualification does not meet current Naval requirements as regards head and capacity characteristics, the manufacturer shall be required to furnish satisfactory evidence that he has produced pumps of a design, head and capacity characteristics equal to those currently required for Naval service. The bureau or agency concerned may require additional qualification tests of any design of pump, which, in its opinion, has been changed sufficiently to require further demonstration of its suitability.
- (c) Any manufacturer whose product has been eligible to be placed on the Qualified Products List as a result of service test shall be required on his first contract or order after being granted qualification to submit a complete unit to the Engineering Experiment Station for a check test which will consist of the qualification tests. The awarding of qualification shall be contingent upon the unit passing the check test.

4.4.4 Qualification granted for class C-1 service of Specification MIL-P-17639 is acceptable for pumps covered by this specification.

4.5 Inspection procedures. - For Naval purchases, the general inspection procedures shall be in accordance with General Specifications for Inspection of Material.

MIL-P-17840(SHIPS)

5. PREPARATION FOR DELIVERY

5.1 Preservation, packaging, packing and marking. - Pumps, repair parts and tools shall be prepared for delivery for domestic shipment - immediate use; domestic shipment and long term storage; or for overseas shipment in accordance with Specification MIL-P-18789 (see 6.1).

5.2 Marking. - Nomenclature used in the marking of interior packages and shipping containers shall be the exact nomenclature of the part or item that has been approved under the contract or order.

6. NOTES

6.1 Ordering data. - Procurement documents should specify the following:

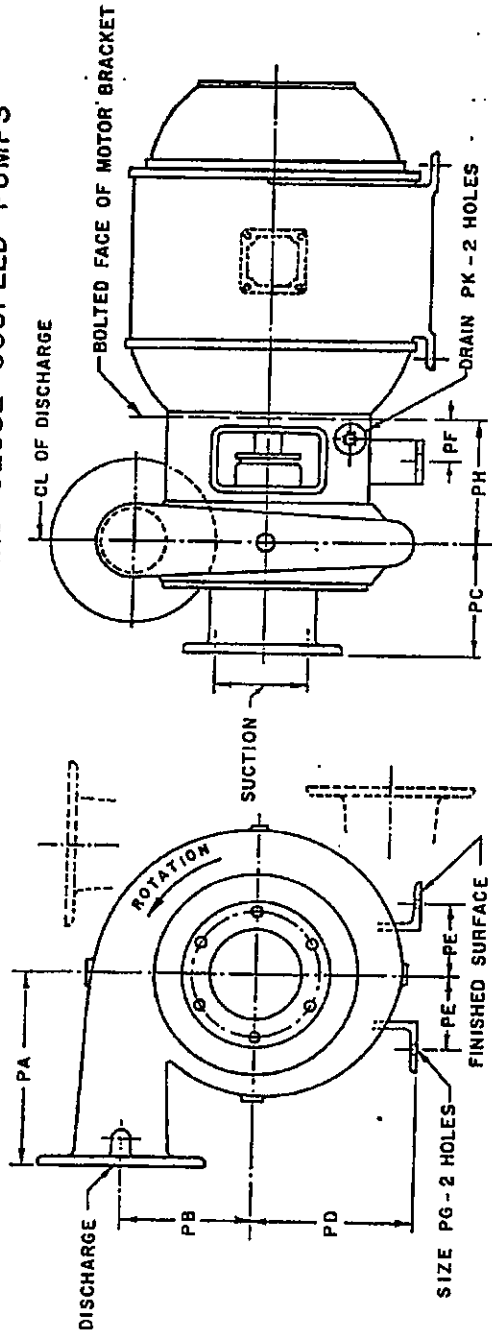
- (a) Title, number, and date of this specification.
- (b) Rated capacity.
- (c) Rated total head.
- (d) Horizontal or vertical installation (see 3.4).
- (e) Liquid handled.
- (f) Specific gravity of liquid handled.
- (g) Liquid temperature.
- (h) Suction head.
- (i) Electrical characteristics (for motor drive) as required by applicable motor and controller specifications.
- (j) Number of sets of repair parts and tools required.
- (k) Whether shipment is for domestic shipment - immediate use; domestic shipment and storage; or for overseas shipment (see 5.1).
- (l) If repair parts boxes are required, specify type (metal or wood) (see 5.1).
- (m) That the following data is required with bids:
 - (1) Sectional assembly drawing of pump.
 - (2) A drawing of the unit showing overall dimensions.
 - (3) Pump characteristic curves.
 - (4) Pump efficiency at rated capacity.
 - (5) Horsepower of driver.
 - (6) Weight of complete unit.
 - (7) The manufacturer and descriptive data of the driver and associated accessories, such as controller.

6.2 In the procurement of products requiring qualification, the right is reserved to reject bids on products that have not been subjected to the required tests and found satisfactory for inclusion on the Military Qualified Products List. The attention of suppliers is called to this requirement, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government, tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. Information pertaining to qualification of products covered by this specification may be obtained from the Chief of the Bureau of Ships, Navy Department, Washington 25, D. C.

Patent notice. - When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

Custodian:
Navy - Bureau of Ships

FIG. 1
OUTLINE DIMENSIONS FOR NAVY STANDARD CLOSE COUPLED PUMPS



PUMP NO.	NAVY SIZE FLANGE DISCH	PA	PB	PC	PD	PE	PF	PG	PK	MOTOR FRAME NUMBER	PH	GROUP SIZE
1	1	1 1/4	3 1/4	3 1/4	3 1/2	2 1/2	2 1/2	9/16	3/8	A.C. 17NC-18NC	57/8	S
2	1	1 1/4	3 1/4	3 1/4	3 1/2	2 1/2	2 1/2	9/16	1/2	D.C. 17NC-18NC	57/8	S
3	1 1/4	1 1/2	4 3/4	3 1/2	4 3/4	2 1/2	2 1/2	9/16	1/2	204NC-224NC	6 1/4	S
4	1 1/4	2	5 1/2	3 3/4	4 3/4	2 1/2	2 1/2	9/16	1/2	224NC-225NC	6 1/4	S
5	2	2 1/2	6 1/2	4 1/2	5 1/2	2 1/2	2 1/2	9/16	1/2	17NC-18NC	5 7/8	S
6	3 1/2	3 1/2	7 1/2	5 1/2	6 1/2	2 1/2	2 1/2	9/16	1/2	204NC-224NC	6 1/4	S
7	1 1/4	2	5 1/2	3 3/4	4 3/4	2 1/2	2 1/2	9/16	1/2	203NC-225NC	6 1/4	S
8	1 1/2	2 1/2	6 1/2	4 1/2	5 1/2	2 1/2	2 1/2	9/16	1/2	203NC-254NC	6 1/4	S
9	2 1/2	3 1/2	7 1/2	5 1/2	6 1/2	2 1/2	2 1/2	9/16	1/2	224NC-254NC	6 1/4	S
10	3 1/2	4 1/2	8 1/2	6 1/2	7 1/2	2 1/2	2 1/2	9/16	1/2	324NC-364NC	8 3/8	M
11	4 1/2	5 1/2	9 1/2	7 1/2	8 1/2	2 1/2	2 1/2	9/16	1/2	324NC-364NC	8 3/8	M
12	6	6 1/2	10 1/2	8 1/2	9 1/2	2 1/2	2 1/2	9/16	1/2	324NC-364NC	8 3/8	M
13	8	8 1/2	12 1/2	10 1/2	11 1/2	2 1/2	2 1/2	9/16	1/2	324NC-364NC	8 3/8	M
14	1	1 1/4	3 1/4	3 1/4	3 1/2	2 1/2	2 1/2	9/16	1/2	284NC-328NC	6 1/4	L
15	2 1/2	3	4 1/4	4 1/4	4 1/2	2 1/2	2 1/2	9/16	1/2	284NC-328NC	6 1/4	S
16	6	7	9 1/2	8 1/2	9 1/2	2 1/2	2 1/2	9/16	1/2	254NC	6 1/4	L
17	2 1/2	3	4 1/4	4 1/4	4 1/2	2 1/2	2 1/2	9/16	1/2	254NC	6 1/4	M

* SUPPORTING FEET PART OF VOLUTE CASING OR COVER

FIG. 3
STANDARD DIMENSIONS OF INTEGRAL HORSEPOWER CLOSE-COUPLED MOTORS

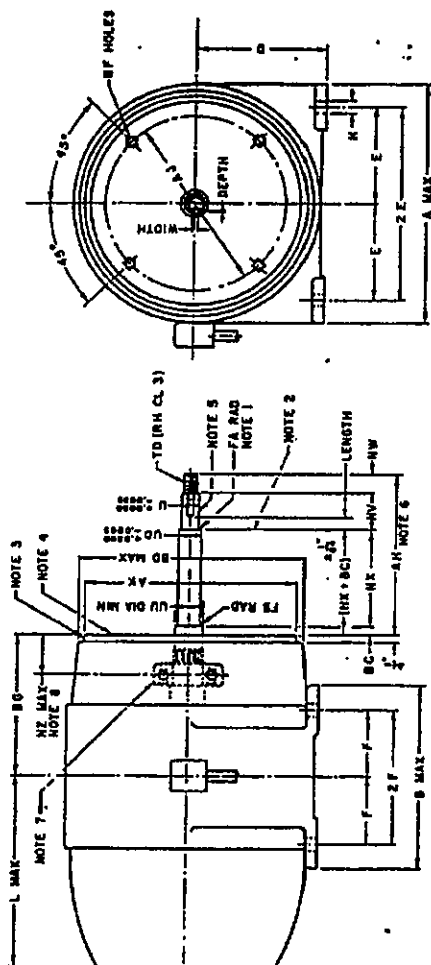


TABLE X
STANDARD FRAME FLANGE AND SHAFT EXTENSION DIMENSIONS AND BEARING SIZES
FOR INTEGRAL HORSEPOWER CLOSE-COUPLED MOTORS
DIMENSIONS IN INCHES

FRAME NO.	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI	BJ	BK	BL	BM	BN	BO	BP	BQ	BR	BS	BT	BU	BV	BW	BX	BY	BZ	CA	CB	CC	CD	CE	CF	CG	CH	CI	CJ	CK	CL	CM	CN	CO	CP	CQ	CR	CS	CT	CU	CV	CW	CX	CY	CZ	DA	DB	DC	DD	DE	DF	DG	DH	DI	DJ	DK	DL	DM	DN	DO	DP	DQ	DR	DS	DT	DU	DV	DW	DX	DY	DZ	EA	EB	EC	ED	EE	EF	EG	EH	EI	EJ	EK	EL	EM	EN	EO	EP	EQ	ER	ES	ET	EU	EV	EW	EX	EY	EZ	FA	FB	FC	FD	FE	FF	FG	FH	FI	FJ	FK	FL	FM	FN	FO	FP	FQ	FR	FS	FT	FU	FV	FW	FX	FY	FZ	GA	GB	GC	GD	GE	GF	GG	GH	GI	GJ	GK	GL	GM	GN	GO	GP	GQ	GR	GS	GT	GU	GV	GW	GX	GY	GZ	HA	HB	HC	HD	HE	HF	HG	HH	HI	HJ	HK	HL	HM	HN	HO	HP	HQ	HR	HS	HT	HU	HV	HW	HX	HY	HZ	IA	IB	IC	ID	IE	IF	IG	IH	II	IJ	IK	IL	IM	IN	IO	IP	IQ	IR	IS	IT	IU	IV	IW	IX	IY	IZ	JA	JB	JC	JD	JE	JF	JG	JH	JI	IJ	JK	KL	KM	KN	KO	KP	KQ	KR	KS	KT	KU	KV	KW	KX	KY	KZ	LA	LB	LC	LD	LE	LF	LG	LH	LI	LJ	LK	LM	LN	LO	LP	LQ	LR	LS	LT	LU	LV	LW	LX	LY	LZ	MA	MB	MC	MD	ME	MF	MG	MH	MI	MJ	MK	ML	MM	MN	MO	MP	MQ	MR	MS	MT	MU	MV	MW	MX	MY	MZ	NA	NB	NC	ND	NE	NF	NG	NH	NI	NJ	NK	NL	NM	NN	NO	NP	NQ	NR	NS	NT	NU	NV	NW	NX	NY	NZ	OA	OB	OC	OD	OE	OF	OG	OH	OI	OJ	OK	OL	OM	ON	OO	OP	OQ	OR	OS	OT	OU	OV	OW	OX	OY	OZ	PA	PB	PC	PD	PE	PF	PG	PH	PI	PJ	PK	PL	PM	PN	PO	PP	PQ	PR	PS	PT	PU	PV	PW	PX	PY	PZ	QA	QB	QC	QD	QE	QF	QG	QH	QI	QJ	QK	QL	QM	QN	QO	QP	QQ	QR	QS	QT	QU	QV	QW	QX	QY	QZ	RA	RB	RC	RD	RE	RF	RG	RH	RI	RJ	RK	RL	RM	RN	RO	RP	RQ	RR	RS	RT	RU	RV	RW	RX	RY	RZ	SA	SB	SC	SD	SE	SF	SG	SH	SI	SJ	SK	SL	SM	SN	SO	SP	SQ	SR	SS	ST	SU	SV	SW	SX	SY	SZ	TA	TB	TC	TD	TE	TF	TG	TH	TI	TJ	TK	TL	TM	TN	TO	TP	TQ	TR	TS	TT	TU	TV	TW	TX	TY	TZ	UA	UB	UC	UD	UE	UF	UG	UH	UI	UJ	UK	UL	UM	UN	UO	UP	UQ	UR	US	UT	UU	UV	UW	UX	UY	UZ	VA	VB	VC	VD	VE	VF	VG	VH	VI	VJ	VK	VL	VM	VN	VO	VP	VQ	VR	VS	VT	VU	VV	VW	VX	VY	VZ	WA	WB	WC	WD	WE	WF	WG	WH	WI	WJ	WK	WL	WM	WN	WO	WP	WQ	WR	WS	WT	WU	WV	WW	WX	WY	WZ	XA	XB	XC	XD	XE	XF	XG	XH	XI	XJ	XK	XL	XM	XN	XO	XP	XQ	XR	XS	XT	XU	XV	XW	XX	XY	XZ	YA	YB	YC	YD	YE	YF	YG	YH	YI	YJ	YK	YL	YM	YN	YO	YP	YQ	YR	YS	YT	YU	YV	YW	YX	YY	YZ	ZA	ZB	ZC	ZD	ZE	ZF	ZG	ZH	ZI	ZJ	ZK	ZL	ZM	ZN	ZO	ZP	ZQ	ZR	ZS	ZT	ZU	ZV	ZW	ZX	ZY	ZZ
-----------	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----

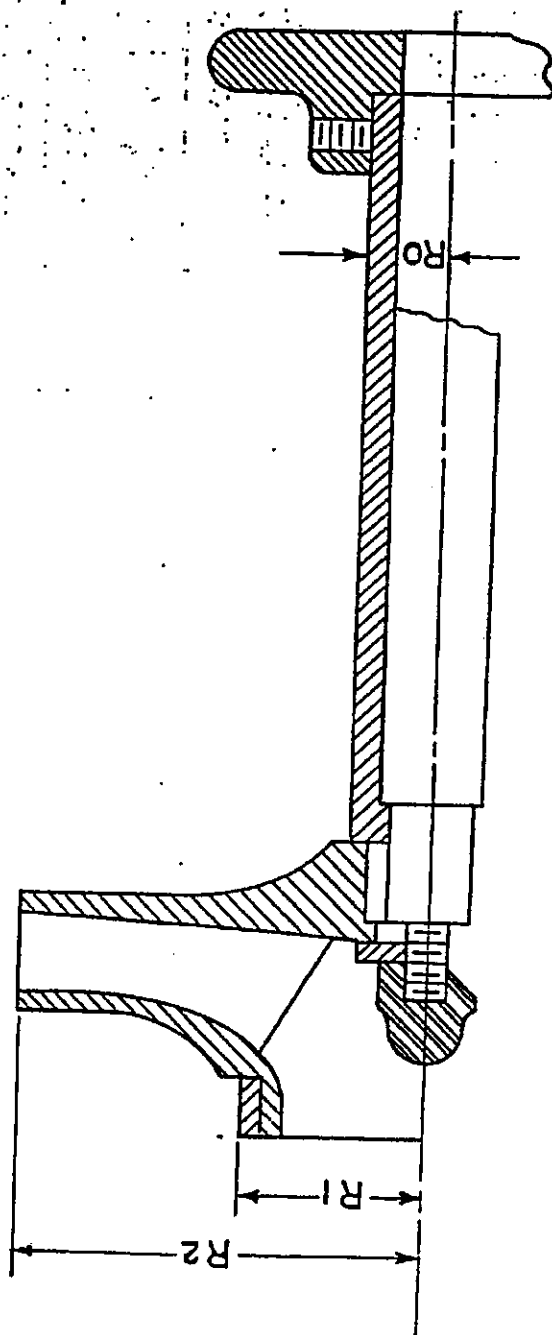
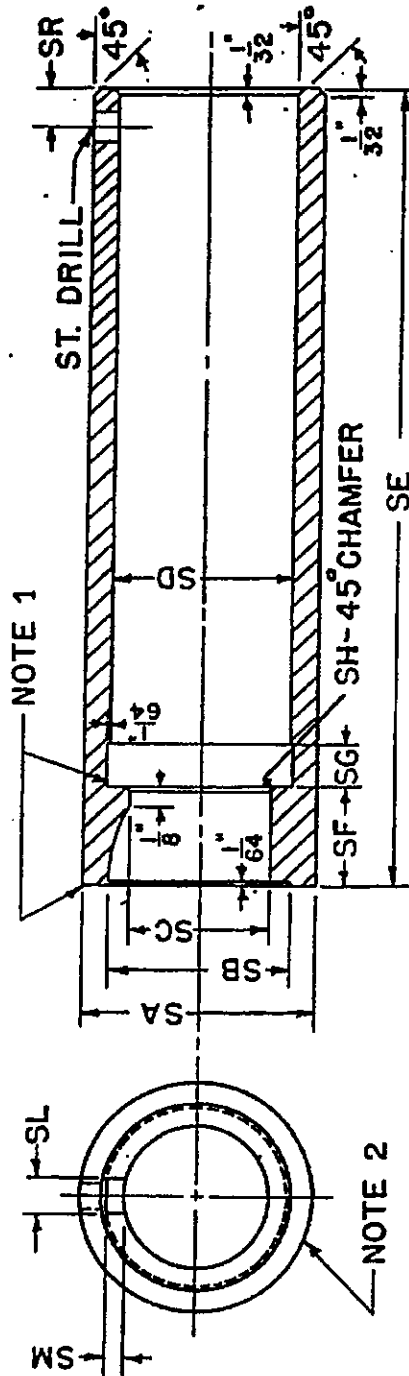


Figure 4. - Outside of shaft sleeve

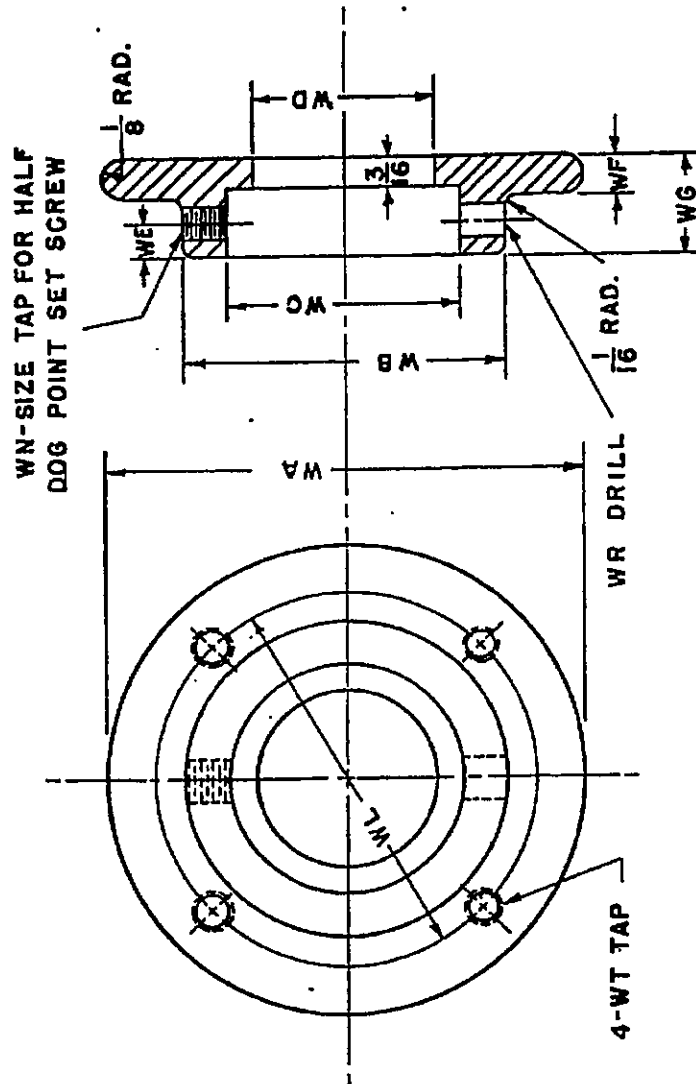
FIG. 5
SHAFT SLEEVE DETAIL



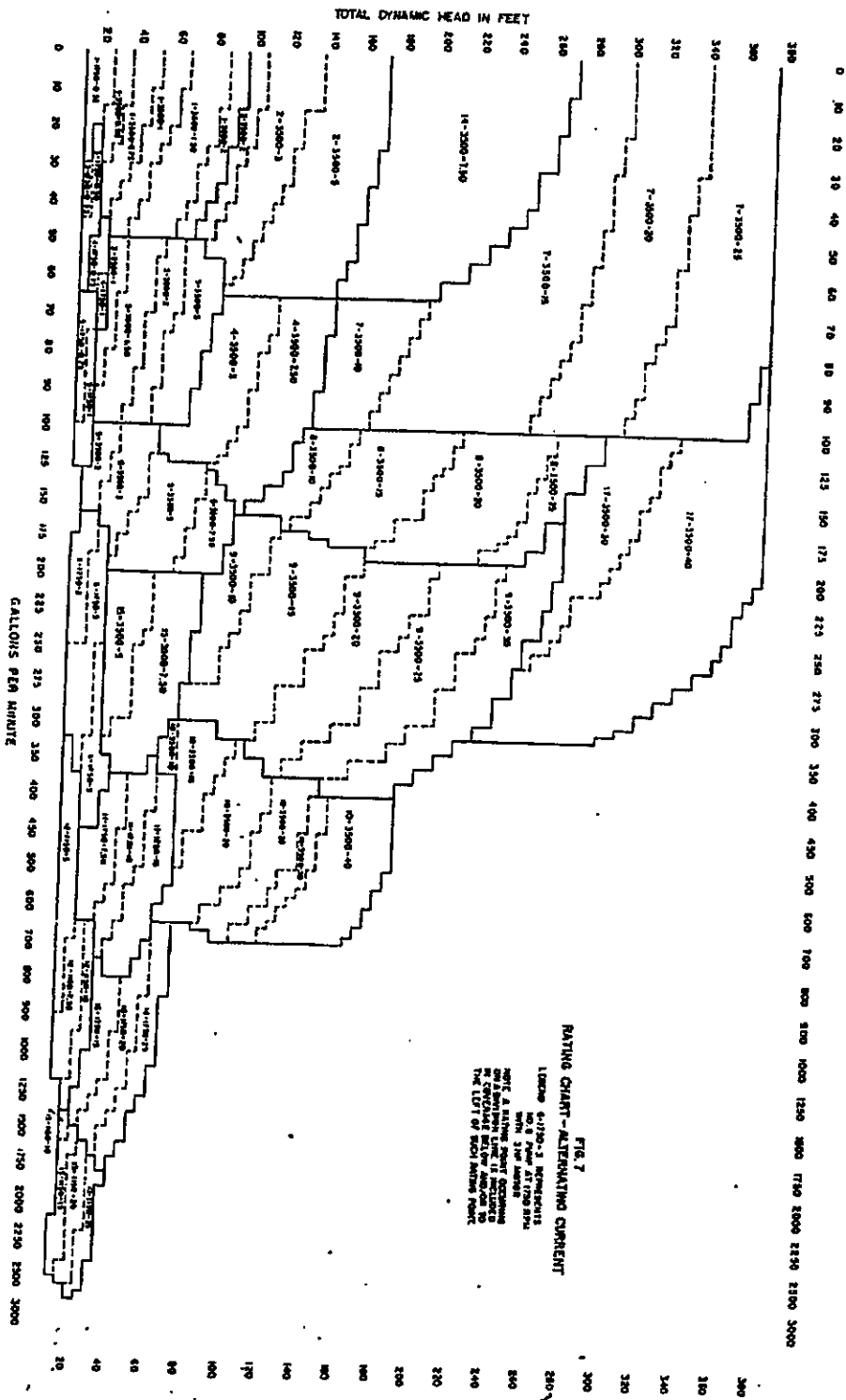
GROUP	SA	SB	SC	SD	SE	SF	SG	SH	SL	SM	SR	ST	SIZE OF STUFFING BOX PACKING
S	1.125	$\frac{15}{16}$	.690	.8760	4	.500	$\frac{1}{4}$	$\frac{1}{32}$	$\frac{3}{16}$	$\frac{3}{32}$	$\frac{3}{16}$	$\frac{5}{32}$	$\frac{1}{8}$ I.D. \times $\frac{5}{8}$ O.D. \times $\frac{1}{4}$ S.Q.
M	1.625	$\frac{5}{16}$	1.003	1.2510	$5\frac{3}{4}$	.625	$\frac{5}{16}$	$\frac{1}{32}$	$\frac{1}{4}$	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{13}{64}$	$\frac{5}{8}$ I.D. \times $2\frac{3}{8}$ O.D. \times $\frac{3}{8}$ S.Q.
L	2.250	$\frac{7}{8}$	1.378	1.7510	$6\frac{3}{4}$	.750	$\frac{3}{8}$	$\frac{1}{16}$	$\frac{3}{8}$	$\frac{3}{16}$	$\frac{5}{16}$	$\frac{1}{4}$	$2\frac{1}{4}$ I.D. \times 3 O.D. \times $\frac{3}{8}$ S.Q.

NOTE 1: SEALING SURFACES TO BE SMOOTH TRUE AND PERPENDICULAR WITH BORE
NOTE 2: OUTSIDE DIAMETER TO BE GROUND SMOOTH TRUE AND CONCENTRIC WITH BORE

FIG. 6
DETAIL OF WATER FLINGER



GROUP	WA	WB	WC	WD	WE	WF	WG	WL	WN	WR	WT	SIZE OF HALF DOG POINT SET SCREW
S	$\frac{7}{8}$	$\frac{3}{4}$	$\frac{1.001}{.000} + \frac{1}{64}$	$\frac{15}{16}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{11}{16}$	$\frac{3}{2}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{5}{16}$	$\frac{1}{4} \times \frac{3}{8}$ LG.
M	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1.626}{.000} + \frac{1}{8}$	$\frac{3}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{3}{4}$	$\frac{3}{2}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{5}{16}$	$\frac{5}{16} \times \frac{3}{8}$ LG.
L	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{2.251}{.000} + \frac{1}{8}$	$\frac{13}{16}$	$\frac{5}{16}$	$\frac{5}{16}$	$\frac{7}{8}$	$\frac{3}{2}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{3}{16}$	$\frac{3}{16} \times \frac{1}{2}$ LG.



15 May 1938

45V17(INT)

BUREAU OF ENGINEERING SPECIFICATION
VALVES, GATE, FOR AIR EXHAUST STEAM, OIL, OR WATER SERVICES
(SHIPBOARD USE)

A. APPLICABLE SPECIFICATIONS AND DRAWINGS.

A-1. The following specifications, of the issue in effect on date of invitation for bids, form a part of this specification, and bidders and contractors should provide themselves with the necessary copies.

NAVY DEPARTMENT SPECIFICATIONS

General Specifications for Inspection of Material, together with Appendix II (Metals).

- 33P14 - Packing, asbestos, valve stem, symbol 1101.
- 33P16 - Packing, asbestos, rod, high pressure, symbol 1100.
- 33P17 - Packing, metallic, flexible, symbols 1430 and 1431.
- 43B11 - Bolts, nuts, studs, tap rivets (and material for same).
- 43B14 - Bolt-studs, nuts, and rod; steel (for service at temp. up to 850° F.)
- 44T2 - Threads, standard, for pipe and pipe fittings.
- 45V1 - Valves, bronze, 100 W.S.P., gate.
- 46B6 - Brass, Naval, rolled.
- 46B8 - Bronze, valve: Castings.
- 46M6 - Metal, gun: Castings.
- 46M7 - Nickel-copper alloy; rods, bars, shapes, etc.
- 46S18 - Steel, corrosion-resisting; bars, rods, and forgings, (except for reforcing).
- 46S27 - Steel, corrosion-resisting: Castings.
- 49S1 - Steel; castings.
- 49S2 - Steel; forgings for hulls, engines and ordnance.

BUREAU OF ENGINEERING SPECIFICATIONS

General Specifications for Machinery, Subsection S1-1.

A-2. The following Bureau of Engineering drawings, of the alteration in effect on date of invitation for bids, form a part of this specification, and bidders and contractors should provide themselves with the necessary copies:

- B-64 - Hand wheels for valves.
- B-139 - Composition flanges, 100 lbs.
- B-140 - Composition flanges, 400 lbs.
- B-141 - Steel flanges, 400 lbs.
- P-153 - Standard application of annual contract packings.
- B-159 - Steel flanges, 600 lbs.
- B-160 - Type quick closing valves.
- B-161 - Type hose gate valve.
- B-173 - Forged steel unions.

45VV17(INT)

-2-

- B-174 - Steel flanges, 750 lbs.
- 3-S-530 - Forged steel welding end fittings.
- 6-Y-554 - Schedule for piping, pipe fittings, valves, etc.

B. CLASSES.

B-1. Gate valves shall be of the following classes:

- Class I - For working pressures not greater than 100 pounds per square inch threaded and flanged ends - composition. (also in steel for oil services, as required by schedule for valves, etc., Bureau drawing 6-Y-554 as listed in Section A.)
- Class II - For working pressures from 101 to 200 pounds per square inch, smaller than 2 inch size, threaded ends - composition.
- Class III - For working pressures from 101 to 400 pounds per square inch threaded, and flanged ends - composition.
- Class IV - For working pressures from 101 to 400 pounds per square inch, sizes 3/4 inch and larger, flanged ends - cast (or forged) steel.
- Class V - For working pressures from 401 to 600 pounds per square inch, sizes 3/4-inch and larger, flanged ends - cast (or forged) steel.
- Class VI - For working pressures from 601 to 750 pounds per square inch, sizes 3/4-inch and larger, flanged ends - cast (or forged) steel.

C. MATERIAL AND WORKMANSHIP.

C-1. Material. Unless otherwise approved, all materials used in the construction of valves shall be as specified in Section E.

C-2. Workmanship.- All castings shall be clean, sound and free from blow holes, porosity, cracks and any other injurious defects. The workmanship shall be first class in all respects.

D. GENERAL REQUIREMENTS.

D-1. Plans.- Plans shall be furnished as required by the bureau concerned.

D-1a. Bureau of Engineering.

D-1a(1). The number, size, arrangement, title, form, etc., shall conform to the requirements of Subsection SI-1, referred to in Section A.

D-1a(2). The specific plans desired and the information thereon shall include the following:

- Type A.
- Type B.
- Type D.

45V17(INT)

-3-

D-1a(3). Type A drawings shall accompany bids.

D-1a(4). The number of sets of Type B and Type D drawings, if required, shall be stated in the requisition, contract or order.

D-2. All valves shall be of the non-rising stem design and so constructed that the stem will not be exposed to the fluid passing through the valve, except that entering the drain hole, when the disk is raised to the full open position.

D-3. All valves when fully open shall permit an unobstructed flow and the area at any point within the valve shall be not less than the inside area of the pipe or tubing to which connected.

D-4. All valves shall be so designed that the valve stem may be packed when the valve is in the full open position.

D-5. All disks shall be of the wedge-type double faced design, made in one piece.

D-6. All valves shall be provided with disk guides cast integral with the body.

D-7. Each disk shall have an opening in the bottom to provide drainage.

D-8. Each stem shall be so threaded with acme type threads that the valve will be opened when the handwheel is turned counter-clockwise. The end of each stem shall be square and tapered to fit the handwheel. The stem shall be threaded above the tapered section to provide for a hexagonal securing nut.

D-9. The stem and thrust collar shall be one integral piece.

D-10. Unless otherwise specified, each valve 2-1/2 inches and larger shall be provided with an indicator to show whether the valve is open or closed.

D-11. Each valve shall have distinctly cast or stamped on one side of the body, the size, the trade mark of the maker "100" for Class I valves, "200" for Class II valves, "400" for Class III valves, "400" for Class IV valves, "600" for Class V valves, and "750" for Class VI valves; and the size of the valve. Valves for oil shall also have the word 'oil' cast or stamped on the bodies.

D-12. Faces of all flanges shall have at least a fine tool finish.

D-13. The walls of bodies and bonnets shall be curved surfaces; no flat surfaces shall be permitted. They shall be ribbed as required to prevent distortion.

45V17(INT)

-4-

D-14. Stuffing boxes shall be separate from the valve bonnets. For valves of 2-1/2 inch size, and above, the glands shall be of the flanged type set up by two nuts working on studs extending through the gland flange.

D-15. All composition gate valves of 2-1/2 inch size and above, and all steel gate valves shall have removable seats. Removable seats shall be screwed into the valve bodies, suitable lugs being provided on the seats for the purpose. The faces of the seats shall be slightly raised at the center to provide a narrow bearing surface not to exceed one-eighth inch in width.

D-16. All gate valves, Classes III, IV, V and VI, 4-1/2 inch size or larger shall be fitted with by passes. The by-pass valves shall be globe valves, the materials of which shall correspond to the gate valves served. The minimum sizes for the by-passes are given below in Table I.

TABLE I.

Size of gate valve	Size of by-pass valve
4-1/2 inches to 7-1/2 inches, incl.	1/2 inch, minimum
8 inches to 9-1/2 inches, incl.	3/4 inch, minimum
10 inches and above	1 inch, minimum

NOTE. - All by-passes shall be connected to their valves by flanged joints.

D-17. Valve stems shall be packed with one of the packings conforming to N.D. Specs. 33P14, 33P16, or 33P17, referred to in Section A.

E. DETAIL REQUIREMENTS.

E-1. Class I Gate Valves.-

E-1a. Valves shall conform in every particular to N.D. Spec. 45V1, referred to in Section A, except those ordered in steel, which shall conform to N.D. Spec. 45V1 for design and subparagraph E-4c(1) for materials, except that the "bolts" or "studs" and "nuts", shall be steel, N.D. Spec. 43B11, referred to in Section A, Classes B and C, respectively.

45V17(INT)

-5-

E-2. Class II Gate Valves.

E-2a. Valves shall be supplied only with threaded ends and in sizes and with dimensions shown in Table II.

TABLE II.

Size of pipe for : which valves are : used	Dimensions	
	Diameter of handwheel-minimum	Distance centerline to top maxi-
Inches	Inches	mm
1/4	1-1/2	4
1/2	1-3/4	4-1/4
3/4	2-1/2	5
1	2-3/4	5-3/4
1-1/4	3	6-1/2
1-1/2	3-1/2	7-1/2

E-2b. The threaded ends shall conform to the requirements of N.D. Spec. 44T2, referred to in Section A.

E-2c. Materials shall be the same as those specified for Class I gate valves.

E-2d. Bonnets may be screwed, or flanged and bolted.

E-2e. Handwheels shall be of malleable iron of non-heat design having three or more spokes. See Table II for minimum diameters.

45V17(INT)

-6-

E-3. Class III Gate Valves

E-3a. Valves shall be supplied with threaded or flanged ends as specified in sizes 1-1/2 inches and smaller; and with flanged ends only in sizes 2 inches and above. The dimensions shall conform to those shown in Table III.

TABLE III.

Size of pipe : or tubing for: which used	Flanged valves			Dimensions	
	Diam. of bore	Face to face	Diameter - minimum	Handwheel	Height - Centerline to top - maximum
Inches	Inches	Inches	Inches	Inches	Inches
1/4	---	---	---	1-3/4	8
1/2	---	---	---	2-1/2	8-1/2
3/4	1	5	---	2-3/4	9
1	1-1/4	5-1/4	3	---	10-1/2
1-1/4	1-1/2	6	3-1/2	---	11
1-1/2	2	7	4	---	12
2	2-1/2	7-1/2	8	---	13
2-1/2	3	8	9	---	15
3	3-1/2	8-1/2	10	---	16
3-1/2	4	9	11	---	17
4	4-1/2	9-1/2	11	---	18-1/2
4-1/2	5	10	12	---	20
5	5-1/2	10-1/4	12	---	21-1/2
5-1/2	6	10-1/2	14	---	23
6	6-1/2	10-3/4	16	---	24-1/2
6-1/2	7	11	18	---	26
7	7-1/2	11-1/4	18	---	27-1/2
7-1/2	8	11-1/2	18	---	29
8	8-1/2	11-3/4	21	---	30-1/2
8-1/2	?	12	21	---	32
9	9-1/2	12-1/2	21	---	33-1/2
9-1/2	10	13	21	---	35
10	10-1/2	13-1/2	21	---	36-1/2

E-3b. The threaded ends shall conform to the requirements of N.D. Spec. 44T2, referred to in Section A.

E-3c. The dimensions of flanges shall conform to Bureau of Engineering drawing B-140, referred to in Section A.

E-3d. Unless otherwise specified, valves shall be delivered with the flanges indrilled.

E-3e. Materials shall be the same as those specified for Class I valves.

45V17(INT)

-7-

E-3f. Bonnets for valves 1-1/2 inches and smaller may be screwed. Those for valves 2 inches and larger shall be flanged. Flanged bonnets shall be bolted with bolt studs threaded full length and fitted with a nut on each end.

E-3g. Handwheels for valves, sizes 1-1/2 inches and smaller, shall be of the same type as specified for Class II valves. Handwheels for valves, sizes 2 inches and larger, shall conform to Bureau of Engineering drawing B-64, referred to in Section A, and shall have diameters not less than those given in Table III.

E-4. Class IV Gate Valves.

E-4a. Valves shall have flanged ends and be made only of steel, cast or forged, in all sizes and of dimensions as shown in Table IV.

TABLE IV.

Size of pipe or : tubing for which : used :	Diameter of :			Dimensions	
	Bore :	Face to Face :	Handwheel : Diameter : Minimum :	Height - Centerline : to : Top - Maximum :	Inches
Inches	Inches	Inches	Inches		Inches
3/4	1	5	3-1/4		10
1	1-1/4	5-1/4	4		11
1-1/4	1-1/2	6	5		11-1/2
1-1/2	2	7	6		12-1/2
2	2-1/2	7-1/2	8		13-1/2
2-1/2	3	8	9		15-1/2
3	3-1/2	8-1/2	10		16-1/2
3-1/2	4	9	11		17-1/2
4	4-1/2	9-1/2	11		19
4-1/2	5	10	12		20-1/2
5	5-1/2	10-1/4	12		22
5-1/2	6	10-1/2	14		23-1/2
6	6-1/2	10-3/4	16		25
6-1/2	7	11	18		26-1/2
7	7-1/2	11-1/4	18		28
7-1/2	8	11-1/2	18		29-1/2
8	8-1/2	11-3/4	21		31
8-1/2	9	12	21		32-1/2
9	9-1/2	12-1/2	21		34
9-1/2	10	13	21		35-1/2
10	10-1/2	13-1/2	21		37

45V17(INT)

-8-

E-4b. The dimension of flanges shall conform to Bureau of Engineering drawing B-141, referred to in Section A.

E-4c. Unless otherwise specified, valves shall be delivered with the flanges undrilled.

E-4d. Materials shall be as follows:

(1) Oil Service.

Body bonnet, stuffing box and gland - Class B cast steel (N.D. Spec. 49S1) or Class B forged steel (N.D. Spec. 49S2).

Disk and seat - Grade 7 corrosion-resisting steel (N.D. Spec. 46S18) or Grade 7 corrosion-resisting steel, cast (N.D. Spec. 46S27). The disk may be Class B cast steel (N.D. Spec. 49S1) fitted with seating face of either of the former materials.

Stem - Grade 7 corrosion-resisting steel (N.D. Spec. 46S18).

Stem nut, index unit and scale - brass.

Bolt-studs and nuts - steel, (N.D. Spec. 43B14).

Bolts and nuts - (N.D. Spec. 43B11).

(2) Air, Exhaust Steam or Water Services.

Body, bonnet and stuffing box - same materials as specified for "Oil Service".

Disk and seat - Gun metal (N.D. Spec. 46M6) or special composition of non-galling characteristics as approved.

Stem - nickel-copper alloy, rolled (N.D. Spec. 46M7).

Stuffing box gland, stem nut, index units and scale - brass.

Bolt-studs and nuts - steel (N.D. Spec. 43B14).

Bolt and nuts - (N.D. Spec. 43B11).

E-4e. Bonnets shall be flanged and bolted with bolt studs threaded full length and fitted with a nut on each end.

E-4f. Handwheels shall conform to Bureau of Engineering drawing B-64, referred to in Section A, and shall have diameters not less than those given in Table IV.

E-5. Class V Gate Valves.

E-5a. Valves shall have flanged ends, shall be made in all sizes, and shall be of the dimensions given in Table V.

45V17(IWT)

-9-

TABLE V.

Size of pipe or tubing for which used	Dimensions				
	Diameter of Bore	Face to face over raised surface	Handwheel Diameter Minimum	Height Center- line to top - maximum	
Inches	Inches	Inches	Inches	Inches	
3/4	3/4	7-1/2	6	8-1/2	
1	1	8-1/2	7	9-1/2	
1-1/4	1-1/4	9	7	11	
1-1/2	1-1/2	9-1/2	8	12-1/2	
2	2	11-1/2	8	15	
2-1/2	2-1/2	13	9	16-5/8	
3	3	14	10	18-1/4	
3-1/2	3-1/2	15	10	19	
4	4	16	12	22	
4-1/2	4-1/2	17	12	24	
5	5	18	14	26	
5-1/2	5-1/2	19	16	27-1/4	
6	6	19-1/2	16	28-1/4	
6-1/2	6-1/2	20-1/2	18	30	
7	7	21-1/2	18	31	
7-1/2	7-1/2	22-1/2	18	33	
8	8	23-1/2	21	35	
8-1/2	8-1/2	24-1/4	21	35	
9	9	25	21	37	
9-1/2	9-1/2	25-3/4	21	38	
10	10	26-1/2	21	39	

E-5b. The dimensions of flanges shall conform to Bureau of Engineering drawings B-159 and 3-S-530 referred to in Section A. Raised surfaces on all valve flanges shall be 1/4-inch in height.

E-5c. Valves shall be furnished with flanges drilled; bolt holes to straddle the center lines.

E-5d. Materials shall be the same as specified for Class IV valves.

E-5e. Bonnets shall be bolted with bolt-studs threaded full length and fitted with a nut on each end.

E-5f. Handwheels shall conform to Bureau of Engineering drawing B-64, referred to in Section A, and shall have diameters not less than those given in Table V.

45V17(INT)

-10-

E-6. Class VI Gate Valves.

E-6a. Valves shall have flanged ends, shall be made in all sizes, and shall be of the dimensions given in Table VI.

TABLE VI.

Size of pipe :			Dimensions		
or tubing for:	Diameter :	Face to face over :	Handwheels :	Height centerline	
which used :	of bore :	raised surface :	Diameter, minimum :	to top - maximum	
Inches	Inches	Inches	Inches	Inches	
3/4	3/4	7-1/2	6	10-1/2	
1	1	8-1/2	7	11	
1-1/4	1-1/4	9	7	11-1/2	
1-1/2	1-1/2	9-1/2	8	13	
2	2	11-1/2	9	16-1/2	
2-1/2	2-1/2	13	9	17	
3	3	14	10	19	
3-1/2	3-1/2	15-1/2	12	19-1/2	
4	4	17	14	24	
4-1/2	4-1/2	18-1/2	14	26	
5	5	20	16	28	
5-1/2	5-1/2	21	18	29	
6	6	22	18	30-1/2	
6-1/2	6-3/8	23	21	32-1/2	
7	6-7/8	24	21	33-1/2	
7-1/2	7-3/8	25	21	35-1/2	
8	7-7/8	26	24	37-1/2	
8-1/2	8-3/8	27-1/4	24	38-1/2	
9	8-3/4	28-1/2	24	39-1/2	
9-1/2	9-1/4	29-3/4	24	40-1/2	
10	9-3/4	31	27	41-1/2	

E-6b. The dimensions of flanges shall conform to Bureau of Engineering drawings B-174 and 3-S-530, referred to in Section A. Raised faces on all valves shall be 1/4-inch in height.

E-6c. Valves shall be furnished with flanges drilled; bolt holes to straddle the center lines.

E-6d. Materials shall be the same as specified for Class IV valves.

E-6e. Bonnets shall be bolted with bolt-studs threaded full length and fitted with a nut on each end.

E-6f. Handwheels shall conform to Bureau of Engineering drawing B-64, referred to in Section A, and shall have diameters not less than those given in Table VI.

45VL7(INT)

-11-

F. METHODS OF SAMPLING, INSPECTION AND TESTS.

F-1. Chemical and physical tests shall be made on samples of material taken during manufacture as required by the specifications covering the various materials used.

F-2. Each valve shall be inspected for defects of workmanship and compliance with specified dimensions.

F-3. Each valve shall be tested as follows:

- (a) By hydrostatic pressure, as tabulated below, for strength and porosity with the gate open.
- (b) By hydrostatic pressure, as tabulated below, for tightness on seat with the gate closed by hand and without the use of a wrench or equivalent, the pressure to be applied alternately on both sides of the gate with the side opposite the pressure open for inspection in each case.

Hydrostatic Test Pressure

	<u>(1) Open</u>	<u>(2) Closed</u>
Class I.....	200 lbs. per sq. in. gage	100 lbs. per sq. in. gage
Class II.....	300 lbs. per sq. in. gage	200 lbs. per sq. in. gage
Class III.....	600 lbs. per sq. in. gage	400 lbs. per sq. in. gage
Class IV.....	750 lbs. per sq. in. gage	400 lbs. per sq. in. gage
Class V.....	1000 lbs. per sq. in. gage	500 lbs. per sq. in. gage
Class VI.....	1500 lbs. per sq. in. gage	750 lbs. per sq. in. gage

F-4. The appliance for the hydrostatic testing of flanged valves shall not restrict longitudinal expansion.

G. PACKAGING, PACKING AND MARKING FOR SHIPMENT.

G-1. Packing.— Unless otherwise specified, the subject commodity shall be delivered in substantial wooden containers so constructed as to insure safe delivery by common or other carriers to the point of delivery at the lowest rate, and to withstand further shipment and handling if necessary without repacking. A single container, when packed for shipment, shall weigh not in excess of approximately 250 pounds gross. Valves weighing in excess of 125 pounds each shall be packed singly. Not more than one size, type, or kind of valves shall be packed in a single container.

G-2. Marking.— Unless otherwise specified, shipping containers shall be marked with the name of the material, the class, size and the quantity contained therein as defined by the contract or order under which shipment is made, the name of the contractor, the number of the contract or order and the gross weight.

45VL7(INT)

-12-

H. NOTES.

H-1. Requisitions and contracts or orders should state the quantity of each class and the size of valves desired and the number of Type B and D drawings desired.

H-2. This specification supersedes Supplementary General Specification for Machinery, SGS(48)-20 formerly issued by the Bureau of Engineering, Navy Department, Washington, D.C.

H-3. Copies of Drawings and Specifications.

H-3a. Copies of Drawings.- Copies of Bureau of Engineering drawings may be obtained only upon application to the Bureau of Engineering, Navy Department, Washington, D.C. When requesting refer to drawings by both title and number.

H-3b. Copies of Bureau of Engineering Specifications.- Copies of Bureau of Engineering Specifications may be obtained only upon application to the Bureau of Engineering, Navy Department, Washington, D.C. When requesting, refer to Specification by both title and number.

H-3c. Copies of Navy Department Specifications.- Copies of Navy Department Specifications may be obtained upon application to the Bureau of Supplies and Accounts, Navy Department, Washington, D.C., except that Naval activities should make application to the Commandant, Navy Yard, New York, N.Y. When requesting, refer to specification by both title and number.

15 January 1938

45V17(117)

BUREAU OF ENGINEERING SPECIFICATION
VALVES, GATE, FOR WATER, OIL, EXHAUST STEAM OR AIR SERVICES
(SHIPBOARD USE)

A. APPLICABLE SPECIFICATIONS AND DRAWINGS.

A-1. The following specifications, of the issue in effect on date of invitation for bids, form a part of this specification, and bidders and contractors should provide themselves with the necessary copies.

NAVY DEPARTMENT SPECIFICATIONS

General Specifications for Inspection of Material, together with Appendix II (Metals).

- 33P14 - Packing, asbestos, valve stem, symbol 1101.
- 33P16 - Packing, asbestos, rod, high pressure, symbol 1100.
- 33P17 - Packing, metallic, flexible, symbols 1430 and 1431.
- 43B11 - Bolts, nuts, studs, tap rivets (and material for same).
- 43B14 - Bolt-studs, nuts, and rod; steel (for service at temp. up to 850° F.)
- 44T2 - Threads, standard, for pipe and pipe fittings.
- 45V1 - Valves, bronze, 100 W.S.P., gate.
- 46B6 - Brass, naval, rolled.
- 46B8 - Bronze, valve: Castings.
- 46M6 - Metal, gun: Castings.
- 46M7 - Nickel-copper alloy; rods, bars, shapes, etc.
- 46S18 - Steel, corrosion-resisting; bars, rods, and forgings (except for reforging).
- 46S27 - Steel, corrosion-resisting: Castings.
- 49S1 - Steel; Castings.
- 49S2 - Steel; Forgings for hulls, engines and ordnance.

BUREAU OF ENGINEERING SPECIFICATIONS

General Specifications for Machinery, Subsection S1-1.

A-2. The following Bureau of Engineering drawings, of the latest alteration in effect on date of invitation for bids, form a part of this specification, and bidders and contractors should provide themselves with the necessary copies:

- B-64 - Hand wheels for valves.
- B-139 - Composition flanges, 100 lbs.
- B-140 - Composition flanges, 200 and 400 lbs.
- B-141 - Steel flanges, 400 lbs.
- B-153 - Standard application of annual contract packings.
- B-159 - Steel flanges, 600 lbs.
- B-160 - Type quick closing valves.
- B-161 - Type hose gate valve.
- B-173 - Forged steel unions.

45V17(INT)

-2-

- B-174 -- Steel flanges.
- 3-S-530 -- Forged steel welding end fittings.
- 6-Y-554 -- Schedule for piping, pipe fittings, valves and type of joints used in piping systems.

B. CLASSES.

B-1. Gate valves shall be of the following classes:

- Class I -- For working pressures not greater than 100 pounds per square inch threaded and flanged ends -- composition. (also in steel for oil services, as required by schedule for valves, etc., Bureau drawing 6-Y-554 as listed in Section A.)
- Class II -- For working pressures from 101 to 200 pounds per square inch, smaller than 2 inch size, threaded ends -- composition.
- Class III -- For working pressures from 101 to 400 pounds per square inch threaded, and flanged ends -- composition.
- Class IV -- For working pressures from 101 to 400 pounds per square inch, sizes 3/4 inch and larger, flanged ends -- cast (or forged) steel.
- Class V -- For working pressures from 401 to 600 pounds per square inch, sizes 3/4 inch and larger, flanged ends -- cast (or forged) steel.
- Class VI -- For working pressures from 601 to 750 pounds per square inch, sizes 3/4 inch and larger, flanged ends -- cast (or forged) steel.

C. MATERIAL AND WORKMANSHIP.

C-1. Departures from Referenced Specifications.-- The use of materials differing from the referenced Navy Department specifications will be considered when it can be clearly demonstrated that an improvement in operating characteristics, or a saving in weight without sacrifice in reliability can be accomplished thereby, or that such substitutes do not preclude the subsequent use of Navy standard materials in effecting repairs or replacements necessitated by service wear. Specific approval shall be obtained where departures are made from the referenced specifications.

C-2. Materials.-- All materials used in the construction of valves shall be as specified in Section E. Alternate materials will be considered in lieu of those specified but their use will only be permitted after the bureau concerned has been satisfied by test or other means that the proposed substitutes fully meet the service requirements.

C-3. Threaded Parts; Standard Bolts, Nuts and Machine Screws.-- Bolts and nuts shall conform to N.D. Specs. 43B11, and 43B14 referred to in Section A.

C-4. Workmanship.-- All castings shall be clean, sound and free from blow holes, porosity, cracks and any other injurious defects. The workmanship shall be first class in all respects.

45V17(INT)

-3-

D. GENERAL REQUIREMENTS.

D-1. Plans.-- Plans shall be furnished as required by the bureau concerned.

D-1a. Bureau of Engineering.

D-1a(1). The number, size, arrangement, title, form, etc., shall conform to the requirements of Subsection SI-1, referred to in Section A.

D-1a(2). The specific plans desired and the information thereon shall include the following:

Type A.
Type B.
Type D.

D-1a(3). Type A drawings shall accompany bids.

D-1a(4). The number of sets of Type B and Type D drawings, if required, shall be stated in the requisition, contract or order.

D-2. All valves shall be of the non-rising stem design and so constructed that the stem will not be exposed to the fluid passing through the valve, except that entering the drain hole, when the disk is raised to the full open position.

D-3. All valves when fully open shall permit an unobstructed flow and the area at any point within the valve shall be not less than the inside area of the pipe or tubing to which connected.

D-4. All valves shall be so designed that the valve stem may be packed when the valve is in the full-open position.

D-5. All disks shall be of the wedge-type double-faced design, made in one piece.

D-6. All valves shall be provided with disk guides cast integral with the body.

D-7. Each disk shall have an opening in the bottom to provide drainage.

D-8. Each stem shall be so threaded with some type threads that the valve will be opened when the handwheel is turned counterclockwise. The end of each stem shall be square and tapered to fit the handwheel. The stem shall be threaded above the tapered section to provide for a hexagonal securing nut.

D-9. The stem and thrust collar shall be one integral piece.

D-10. Unless otherwise specified, each valve 2-1/3 inches and larger shall be provided with an indicator to show whether the valve is open or closed.

D-11. Each valve shall have distinctly cast or stamped on one side of the body, the size, the trade mark of the maker, "100" for Class I valves, "200" for Class II valves, "400" for Class III valves, "300" for Class IV valves, "400" for Class V valves, and "500" for Class VI valves; and the size of the valve. Valves for oil shall also have the word 'oil' cast or stamped on the bodies.

45V17(INT)

-4-

D-12. The walls of bodies and bonnets shall be curved surfaces; no flat surfaces shall be permitted. They shall be ribbed as required to prevent distortion.

D-13. Stuffing boxes shall be separate from the valve bonnets. For valves of 2-1/2 inch size, and above, the glands shall be of the flanged type set up by two nuts working on studs extending through the gland flange.

D-14. All composition gate valves of 2-1/2 inch size and above, and all steel gate valves shall have removable seats. Removable seats shall be screwed into the valve bodies, suitable lugs being provided on the seats for the purpose. The faces of the seats shall be slightly raised at the center to provide a narrow bearing surface not to exceed one-eighth inch in width.

D-15. All gate valves, Classes III, IV, V and VI, 4-1/2 inch size or larger shall be fitted with by-passes. The by-pass valves shall be globe valves, the materials of which shall correspond to the gate valves served. The minimum sizes for the by-passes are given below in Table I.

TABLE I.

Size of gate valve	Size of by-pass valve
4-1/2 inches to 7-1/2 inches, incl.....	1/2 inch, minimum
8 inches to 9-1/2 inches, incl.:	3/4 inch, minimum
10 inches.....	1-inch, minimum

NOTE:- All by-passes shall be connected to their valves by flanged joints.

D-16. Valves stems shall be packed with one of the packings conforming to N.D. Specs. 33P14, 33P16, or 33P17, referred to in Section A.

E. DETAIL REQUIREMENTS.

E-1. Class I Gate Valves.

E-1a. Valves shall conform in every particular to N.D. Specs. 45V1, referred to in Section A, except when ordered in steel, which shall conform to N.D. Specs. 45V1 for design and subparagraph E-4c(1) for materials, but the "bolts" or "studs" and "nuts", shall be steel, N.D. Specs. 43E11, referred to in Section A, Classes B and C, respectively.

E-2. Class II Gate Valves.

E-2a. Valves shall be supplied only with threaded ends and in sizes and with dimensions shown in Table II.

TABLE II.

Size of Pipe for: which Valves are: used		Dimensions	
		Diameter of handwheel-minimum	Distance centerline to top maxi-
Inches	:	Inches	mm
1/4	:	1-1/2	4
1/2	:	1-3/4	4-1/4
3/4	:	2-1/2	5
1	:	2-3/4	5-3/4
1-1/4	:	3	6-1/2
1-1/2	:	3-1/2	7-1/2

E-2b. The threaded ends shall conform to the requirements of N.D. Specs. 44T2, referred to in Section A.

E-2c. Materials shall be the same as those specified for Class I gate valves.

E-2d. Bonnets may be screwed, or flanged and bolted.

E-2e. Handwheels shall be of malleable iron of non-heat design having three or more spokes. See Table II for minimum diameters.

E-3. Class III Gate Valves.

E-3a. Valves shall be supplied with threaded or flanged ends as specified in sizes 1-1/2 inches and smaller; and with flanged ends only in sizes 2 inches and above. The dimensions shall conform to those shown in Table III.

TABLE III.

Size of Pipe :		Dimensions			
or Tubing for:		Flanged Valves		Handwheel	Height - Centerline
which used		Diam. of Bore	Face to Face	Diameter- minimum	: to Top-Maximum
Inches	:	Inches	Inches	Inches	Inches
1/4	:	---	---	1-3/4	8
1/2	:	---	---	2-1/2	8-1/2
3/4	:	1	5	2-3/4	9
1	:	1-1/4	5-1/4	3	10-1/2
1-1/4	:	1-1/2	6	3-1/2	11
1-1/2	:	2	7	4	12
2	:	2-1/2	7-1/2	8	13
2-1/2	:	3	8	9	15
3	:	3-1/2	8-1/2	10	16
3-1/2	:	4	9	11	17
4	:	4-1/2	9-1/2	11	18-1/2
4-1/2	:	5	10	12	20
5	:	5-1/2	10-1/4	12	21-1/2
5-1/2	:	6	10-1/2	14	23
6	:	6-1/2	10-3/4	16	24-1/2
6-1/2	:	7	11	18	26
7	:	7-1/2	11-1/4	18	27-1/2
7-1/2	:	8	11-1/2	18	29
8	:	8-1/2	11-3/4	21	30-1/2
8-1/2	:	9	12	21	32
9	:	9-1/2	12-1/2	21	33-1/2
9-1/2	:	10	13	21	35
10	:	10-1/2	13-1/2	21	36-1/2

45V17(INT)

-6-

E-3b. The threaded ends shall conform to the requirements of M. D. Specs. 44T2, referred to in Section A.

E-3c. The dimensions of flanges shall conform to Bureau standard E-140, referred to in Section A.

E-3d. Materials shall be the same as those specified for Class I valves.

E-3e. Bonnets for valves 1-1/2 inches and smaller may be screwed. Those for valves 2 inches and larger shall be flanged. Flanged bonnets shall be bolted with bolt studs threaded full length and fitted with a nut on each end.

E-3f. Handwheels for valves, sizes 1-1/2 inches and smaller, shall be of the same type as specified for Class II valves. Handwheels for valves, sizes 2 inches and larger, shall conform to Bureau standard E-64, referred to in Section A, and with diameters not less than those given in Table III.

E-4. Class IV Gate Valves.

E-4a. Valves shall have flanged ends and be supplied only of steel, cast or forged, in all sizes and of dimensions as shown in Table IV.

TABLE IV.

Size of Pipe or Tubing for which used	Dimensions				
	Diameter of Bore	Face to Face	Handwheel: Height-Centerline Diameter : to Minimum : top-maximum		
			Inches	Inches	Inches
Inches	Inches	Inches	Inches	Inches	Inches
3/4	1	5	3-1/4	:	10
1	1-1/4	5-1/4	4	:	11
1-1/4	1-1/2	6	5	:	11-1/2
1-1/2	2	7	6	:	12-1/2
2	2-1/2	7-1/2	8	:	13-1/2
2-1/2	3	8	9	:	15-1/2
3	3-1/2	8-1/2	10	:	16-1/2
3-1/2	4	9	11	:	17-1/2
4	4-1/2	9-1/2	11	:	19
4-1/2	5	10	12	:	20-1/2
5	5-1/2	10-1/4	12	:	22
5-1/2	6	10-1/2	14	:	23-1/2
6	6-1/2	10-3/4	16	:	25
6-1/2	7	11	18	:	26-1/2
7	7-1/2	11-1/4	18	:	28
7-1/2	8	11-1/2	18	:	29-1/2
8	8-1/2	11-3/4	21	:	31
8-1/2	9	12	21	:	32-1/2
9	9-1/2	12-1/2	21	:	34
9-1/2	10	13	21	:	35-1/2
10	10-1/2	13-1/2	21	:	37

45V17(INT)

-7-

E-4b. The dimension of flanges shall conform to Bureau standard B-141, referred to in Section A.

E-4c. Materials shall be as follows:

(1) Oil Service.

Body, bonnet, stuffing box and gland - Class D cast steel (N.D. Specs. 49S1) or Class B forged steel (N.D. Specs. 49S2).
Disk and seat - CRS-1 corrosion-resisting steel (N.D. Specs. 46S18) or free machining cast corrosion-resisting steel (N.D. Specs. 46S27).
The disk may be Class D cast steel (N.D. Specs. 49S1) fitted with seating face of either of the former materials.
Stem - CRS-7 corrosion-resisting steel (N.D. Specs. 46S18).
Stem nut, index unit and scale - brass.
Bolt-studs and nuts - steel, (N.D. Specs. 43B14).
Bolts and nuts - (N.D. Specs. 43B11).

(2) Air, Exhaust Steam or Water Services.

Body, bonnet and stuffing box - same materials as specified for "Oil Service".
Disk and seat - Gun metal (N.D. Specs. 46M6) or special composition of non-galling characteristics as approved.
Stem - nickel-copper alloy, rolled (N.D. Specs. 46M7).
Stuffing box gland, stem nut, index units and scale - brass.
Bolt-studs and nuts - steel (N.D. Specs. 43B14).
Bolt and nuts - (N.D. Specs. 43B11).

E-4d. Bonnets shall be flanged and bolted with bolt studs threaded full length and fitted with a nut on each end.

E-4e. Handwheels shall conform to Bureau standard B-64, referred to in Section A, and with diameters not less than those given in Table IV.

E-5. Class V Gate Valves.

E-5a. Valves shall have flanged ends and be made in all sizes and of the dimensions given in Table V.

45V17(INT)

-B-

TABLE V.

Size of Pipe or Tubing for which: used	Dimensions				
	Diameter of	Face to face over	Handwheel	Height Center-	
	Bore	raised surface	Diameter Minimum	line to top - maximum	
Inches	Inches	Inches	Inches	Inches	
3/4	3/4	7-1/2	6	8-1/2	
1	1	8-1/2	7	9-1/2	
1-1/4	1-1/4	9	7	11	
1-1/2	1-1/2	9-1/2	8	12-1/2	
2	2	11-1/2	8	15	
2-1/2	2-1/2	13	9	16-5/8	
3	3	14	10	18-1/4	
3-1/2	3-1/2	15	10	19	
4	4	16	12	22	
4-1/2	4-1/2	17	12	24	
5	5	18	14	26	
5-1/2	5-1/2	19	16	27-1/4	
6	6	19-1/2	16	28-1/4	
6-1/2	6-1/2	20-1/2	18	30	
7	7	21-1/2	18	31	
7-1/2	7-1/2	22-1/2	18	33	
8	8	23-1/2	21	35	
8-1/2	8-1/2	24-1/4	21	36	
9	9	25	21	37	
9-1/2	9-1/2	25-3/4	21	38	
10	10	26-1/2	21	39	

E-5b. The dimensions of flanges shall conform to Bureau drawings B-159 and 3-S-530 referred to in Section A. Raised surfaces on all valve flanges shall be 1/4 inch in height.

E-5c. Materials shall be the same as specified for Class IV valves.

E-5d. Bonnets shall be bolted with bolt-studs threaded full length and fitted with a nut on each end.

E-5e. Handwheels shall conform to Bureau standard B-64, referred to in Section A, and with diameters not less than those given in Table V.

45V17(INT)

-9-

E-6. Class VI Gate Valves.

E-6a. Valves shall have flanged ends and be made in all sizes and of the dimensions given in Table VI.

TABLE VI.

Size of pipe or tubing for which used	Dimensions			
	Diameter of bore	Face to face over raised surface	Handwheel Diameter, minimum	Height centerline to top - maximum
Inches	Inches	Inches	Inches	Inches
3/4	3/4	7-1/2	6	10-1/2
1	1	8-1/2	7	11
1-1/4	1-1/4	9	7	11-1/2
1-1/2	1-1/2	9-1/2	8	13
2	2	11-1/2	9	16-1/2
2-1/2	2-1/2	13	9	17
3	3	14	10	19
3-1/2	3-1/2	15-1/2	12	19-1/2
4	4	17	14	24
4-1/2	4-1/2	18-1/2	14	26
5	5	20	16	28
5-1/2	5-1/2	21	18	29
6	6	22	18	30-1/2
6-1/2	6-3/8	23	21	32-1/2
7	6-7/8	24	21	33-1/2
7-1/2	7-3/8	25	21	35-1/2
8	7-7/8	26	24	37-1/2
8-1/2	8-3/8	27-1/4	24	38-1/2
9	8-3/4	28-1/2	24	39-1/2
9-1/2	9-1/4	29-3/4	24	40-1/2
10	9-3/4	31	27	41-1/2

E-6b. The dimensions of flanges shall conform to Bureau drawings B-174 and 3-S-530, referred to in Section A. Raised faces on all valves shall be 1/4-inch in height.

E-6c. Materials shall be the same as specified for Class IV valves.

E-6d. Bonnets shall be bolted with bolt-studs threaded full length and fitted with a nut on each end.

E-6e. Handwheels shall conform to Bureau standard B-64, referred to in Section A, and with diameters not less than those given in Table VI.

45V17(INT)

-10-

F. METHODS OF SAMPLING, INSPECTION AND TESTS.

F-1. Chemical and physical tests shall be made on samples of material taken during manufacture as required by the specifications covering the various materials used.

F-2. Each valve shall be inspected for defects of workmanship and compliance with specified dimensions.

F-3. Each valve shall be tested as follows:

- (a) By hydrostatic pressure, as tabulated below, for strength and porosity with the gate open.
- (b) By hydrostatic pressure, as tabulated below, for tightness on seat with the gate closed by hand and without the use of a wrench or equivalent, the pressure to be applied alternately on both sides of the gate with the side opposite the pressure open for inspection in each case.

Hydrostatic Test Pressures

	<u>(1) Open</u>	<u>(2) Closed</u>
Class I -----	150 lbs. per sq. in. gage	100 lbs. per sq. in. gage
Class II -----	300 lbs. per sq. in. gage	200 lbs. per sq. in. gage
Class III -----	600 lbs. per sq. in. gage	400 lbs. per sq. in. gage
Class IV -----	750 lbs. per sq. in. gage	400 lbs. per sq. in. gage
Class V -----	1000 lbs. per sq. in. gage	500 lbs. per sq. in. gage
Class VI -----	1500 lbs. per sq. in. gage	750 lbs. per sq. in. gage

F-4. The appliance for the hydrostatic testing of flanged valves shall not restrict longitudinal expansion.

G. PACKAGING, PACKING AND MARKING FOR SHIPMENT.

G-1. Packing.-- Unless otherwise specified, valves shall be delivered in substantial commercial containers so constructed as to insure acceptance by common or other carrier for safe transportation at the lowest rate to the point of delivery.

G-2. Marking.-- Unless otherwise specified, shipping containers shall be marked with the name of the material, the class, size and the quantity contained therein as defined by the contract or order under which shipment is made, the name of the contractor and the number of the contract or order.

45V17(INT)

-11-

H. NOTES.

H-1. Requisitions and contracts or orders should state the quantity of each class and the size of valves desired and the number of Type B and D drawings desired.

H-2. This specification supersedes Supplementary General Specification for Machinery, SGS(48)-20 formerly issued by the Bureau of Engineering, Navy Department, Washington, D. C.

H-3. Copies of Drawings and Specifications.-

H-3a. Copies of Drawings.- Copies of Bureau of Engineering drawings may be obtained only upon application to the Bureau of Engineering, Navy Department, Washington, D. C. When requesting, refer to drawings by both title and number.

H-3b. Copies of Bureau of Engineering Specifications.- Copies of Bureau of Engineering Specifications may be obtained only upon application to the Bureau of Engineering, Navy Department, Washington, D. C. When requesting, refer to Specification by both title and number.

H-3c. Copies of Navy Department Specifications.- Copies of Navy Department Specifications may be obtained upon application to the Bureau of Supplies and Accounts, Navy Department, Washington, D. C. When requesting, refer to specification by both title and number.

10 November 1937

45V17(INT)

BUREAU OF ENGINEERING SPECIFICATION
VALVES, GATE, FOR WATER, OIL, EXHAUST STEAM OR AIR SERVICES
(SHIPBOARD USE)

A. APPLICABLE SPECIFICATIONS AND DRAWINGS.

A-1. The following specifications, of the issue in effect on date of invitation for bids, form a part of this specification, and bidders and contractors should provide themselves with the necessary copies.

NAVY DEPARTMENT SPECIFICATIONS

General Specifications for Inspection of Material, together with Appendix II (Metals).

- 33P14 -- Packing, asbestos, valve stem, symbol 1101.
- 33P16 -- Packing, asbestos, rod, high pressure, symbol 1100.
- 33P17 -- Packing, metallic, flexible, symbols 1430 and 1431.
- 43B11 -- Bolts, nuts, studs, tap rivets (and material for same).
- 43B14 -- Bolt-studs, nuts, and rod; steel (for service at temp. up to 850° F.)
- 44T2 -- Threads, standard, for pipe and pipe fittings.
- 45V1 -- Valves, bronze, 100 W.S.P., gate.
- 46B6 -- Brass, naval, rolled.
- 46B8 -- Bronze, valve: Castings.
- 46M5 -- Metal, gun: Castings.
- 46M7 -- Nickel-copper alloy; rods, bars, shapes, etc.
- 46S18 -- Steel, corrosion-resisting; bars, rods, and forgings (except for reforging).
- 46S27 -- Steel, corrosion-resisting: Castings.
- 49S1 -- Steel; Castings.
- 49S2 -- Steel; Forgings for hulls, engines and ordnance.

BUREAU OF ENGINEERING SPECIFICATIONS

General Specifications for Machinery, Subsection S1-1.

A-2. The following Bureau of Engineering drawings, of the latest alteration in effect on date of invitation for bids, form a part of this specification, and bidders and contractors should provide themselves with the necessary copies:

- B-64 -- Hand wheels for valves.
- B-139 -- Composition flanges, 100 lbs.
- B-140 -- Composition flanges, 200 and 400 lbs.
- B-141 -- Steel flanges, 400 lbs.
- B-153 -- Standard application of annual contract packings.
- B-159 -- Steel flanges, 600 lbs.
- B-160 -- Type quick closing valves.
- B-161 -- Type hose gate valve.
- B-173 -- Forged steel unions.

45V17(INT)

-2-

- B-174 -- Steel flanges.
- 3-S-530 -- Forged steel welding end fittings.
- 6-Y-554 -- Schedule for piping, pipe fittings, valves and type of joints used in piping systems.

B. CLASSES.

B-1. Gate valves shall be of the following classes:

- Class I -- For working pressures not greater than 100 pounds per square inch threaded and flanged ends -- composition. (also in steel for oil services, as required by schedule for valves, etc., Bureau drawing 6-Y-554 as listed in Section A.)
- Class II -- For working pressures from 101 to 200 pounds per square inch, smaller than 2 inch size, threaded ends -- composition.
- Class III -- For working pressures from 101 to 400 pounds per square inch threaded, and flanged ends -- composition.
- Class IV -- For working pressures from 101 to 400 pounds per square inch, sizes 3/4 inch and larger, flanged ends -- cast (or forged) steel.
- Class V -- For working pressures from 401 to 600 pounds per square inch, sizes 3/4 inch and larger, flanged ends -- cast (or forged) steel.
- Class VI -- For working pressures from 601 to 750 pounds per square inch, sizes 3/4 inch and larger, flanged ends -- cast (or forged) steel.

C. MATERIAL AND WORKMANSHIP.

C-1. Departures from Referenced Specifications.-- The use of materials differing from the referenced Navy Department specifications will be considered when it can be clearly demonstrated that an improvement in operating characteristics, or a saving in weight without sacrifice in reliability can be accomplished thereby, or that such substitutes do not preclude the subsequent use of Navy standard materials in effecting repairs or replacements necessitated by service wear. Specific approval shall be obtained where departures are made from the referenced specifications.

C-2. Materials.-- All materials used in the construction of valves shall be as specified in Section E. Alternate materials will be considered in lieu of those specified but their use will only be permitted after the bureau concerned has been satisfied by test or other means that the proposed substitutes fully meet the service requirements.

C-3. Threaded Parts; Standard Bolts, Nuts and Machine Screws.-- Bolts and nuts shall conform to N.D. Specs. 43B11, and 43B14 referred to in Section A.

C-4. Workmanship.-- All castings shall be clean, sound and free from blow holes, porosity, cracks and any other injurious defects. The workmanship shall be first class in all respects.

-3-

D. GENERAL REQUIREMENTS.

D-1. Plans. Plans shall be furnished as required by the bureau concerned.

D-1a. Bureau of Engineering.

D-1a(1). The number, size, arrangement, title, form, etc., shall conform to the requirements of Subsection SI-1, referred to in Section A.

D-1a(2). The specific plans desired and the information thereon shall include the following:

Type A.
Type B.
Type C.

D-1a(3). Type A drawings shall accompany bids.

D-1a(4). The number of sets of Type B and Type C drawings, if required, shall be stated in the requisition, contract or order.

D-2. All valves shall be of the non-rising stem design and so constructed that the stem will not be exposed to the fluid passing through the valve, except that entering the drain hole, when the disk is raised to the full open position.

D-3. All valves when fully open shall permit an unobstructed flow and the area at any point within the valve shall be not less than the inside area of the pipe or tubing to which connected.

D-4. All valves shall be so designed that the valve stem may be packed when the valve is in the full-open position.

D-5. All disks shall be of the wedge-type double-faced design, made in one piece.

D-6. All valves shall be provided with disk guides cast integral with the body.

D-7. Each disk shall have an opening in the bottom to provide drainage.

D-8. Each stem shall be so threaded with acme type threads that the valve will be opened when the handwheel is turned counterclockwise. The end of each stem shall be square and tapered to fit the handwheel. The stem shall be threaded above the tapered section to provide for a hexagonal securing nut.

D-9. The stem and thrust collar shall be one integral piece.

D-10. Unless otherwise specified, each valve 2-1/2 inches and larger shall be provided with an indicator to show whether the valve is open or closed.

D-11. Each valve shall have distinctly cast or stamped on one side of the body the trade mark of the maker, "100" for Class I valves, "200" for Class II valves, "400" for Class III valves, "300" for Class IV valves, "400" for Class V valves, and "600" for Class VI valves; and the size of the valve. Valves for oil shall also have the word 'oil' cast or stamped on the bodies.

45V17(INT)

-4-

D-12. The walls of bodies and bonnets shall be curved surfaces; no flat surfaces shall be permitted. They shall be ribbed as required to prevent distortion.

D-13. Stuffing boxes shall be separate from the valve bonnets. For valves of 2-1/2 inch size, and above, the glands shall be of the flanged type set up by two nuts working on studs extending through the gland flange.

D-14. All composition gate valves of 2-1/2 inch size and above, and all steel gate valves shall have removable seats. Removable seats shall be screwed into the valve bodies, suitable lugs being provided on the seats for the purpose. The faces of the seats shall be slightly raised at the center to provide a narrow bearing surface not to exceed one-eighth inch in width.

D-15. All gate valves, Classes III, IV, V and VI, 4-1/2 inch size or larger shall be fitted with by-passes. The by-pass valves shall be globe valves, the materials of which shall correspond to the gate valves served. The minimum sizes for the by-passes are given below in Table I.

TABLE I.

Size of gate valve	Size of by-pass valve
4-1/2 inches to 7-1/2 inches, incl.	1/2 inch, minimum
8 inches to 9-1/2 inches, incl.	3/4 inch, minimum
10 inches and above	1-inch, minimum

NOTE:- All by-passes shall be connected to their valves by flanged joints.

D-16. Valve stems shall be packed with one of the packings conforming to M.D. Specs. 33P14, 33P16, or 33P17, referred to in Section A.

E. DETAIL REQUIREMENTS.

E-1. Class I Gate Valves.

E-1a. Valves shall conform in every particular to M.D. Specs. 45V1, referred to in Section A, except when ordered in steel, which shall conform to M.D. Specs. 45V1 for design and subparagraph E-4c(1) for materials, but the "bolts" or "studs" and "nuts", shall be steel, M.D. Specs. 45E11, referred to in Section A, Classes B and C, respectively.

E-2. Class II Gate Valves.

E-2a. Valves shall be supplied only with threaded ends and in sizes and with dimensions shown in Table II.

TABLE II.

Size of Pipe for: which Valves are: used :		Dimensions	
		Diameter of handwheel—minimum	Distance centerline to top maximum
Inches	:	Inches	Inches
1/4	:	1-1/2	4
1/2	:	1-3/4	4-1/4
3/4	:	2-1/2	5
1	:	2-3/4	5-3/4
1-1/4	:	3	6-1/2
1-1/2	:	3-1/2	7-1/2

E-2b. The threaded ends shall conform to the requirements of N.D. Specs. 4422, referred to in Section A.

E-2c. Materials shall be the same as those specified for Class I gate valves.

E-2d. Bonnets may be screwed, or flanged and bolted.

E-2e. Handwheels shall be of malleable iron of non-heat design having three or more spokes. See Table II for minimum diameters.

E-3. Class III Gate Valves.

E-3a. Valves shall be supplied with threaded or flanged ends as specified in sizes 1-1/2 inches and smaller; and with flanged ends only in sizes 2 inches and above. The dimensions shall conform to those shown in Table III.

TABLE III.

Size of Pipe : or Tubing for:		Dimensions			
		Flanged Valves		Handwheel	Height — Centerline
which used :		Diam. of Bore:	Face to Face:	Diameter— minimum	: to Top—Maximum
Inches	:	Inches	Inches	Inches	Inches
1/4	:	—	—	1-3/4	8
1/2	:	—	—	2-1/2	8-1/2
3/4	:	1	5	2-3/4	9
1	:	1-1/4	5-1/4	3	10-1/2
1-1/4	:	1-1/2	6	3-1/2	11
1-1/2	:	2	7	4	12
2	:	2-1/2	7-1/2	8	13
2-1/2	:	3	8	9	15
3	:	3-1/2	8-1/2	10	16
3-1/2	:	4	9	11	17
4	:	4-1/2	9-1/2	11	18-1/2
4-1/2	:	5	10	12	20
5	:	5-1/2	10-1/4	12	21-1/2
5-1/2	:	6	10-1/2	14	23
6	:	6-1/2	10-3/4	16	24-1/2
6-1/2	:	7	11	18	26
7	:	7-1/2	11-1/4	18	27-1/2
7-1/2	:	8	11-1/2	18	29
8	:	8-1/2	11-3/4	21	30-1/2
8-1/2	:	9	12	21	32
9	:	9-1/2	12-1/2	21	33-1/2
9-1/2	:	10	13	21	35
10	:	10-1/2	13-1/2	21	36-1/2

45V17(INT)

-6-

E-3b. The threaded ends shall conform to the requirements of N. D. Specs. 44T2, referred to in Section A.

E-3c. The dimensions of flanges shall conform to Bureau standard B-140, referred to in Section A.

E-3d. Materials shall be the same as those specified for Class I valves.

E-3e. Bonnets for valves 1-1/2 inches and smaller may be screwed. Those for valves 2 inches and larger shall be flanged. Flanged bonnets shall be bolted with bolt studs threaded full length and fitted with a nut on each end.

E-3f. Handwheels for valves, sizes 1-1/2 inches and smaller, shall be of the same type as specified for Class II valves. Handwheels for valves, sizes 2 inches and larger, shall conform to Bureau standard B-64, referred to in Section A, and with diameters not less than those given in Table III.

E-4. Class IV Gate Valves.

E-4a. Valves shall have flanged ends and be supplied only of steel, cast or forged, in all sizes and of dimensions as shown in Table IV.

TABLE IV.

Size of Pipe or Tubing for which used	Diameter of Bore	Face to Face	Dimensions	
			Handwheel Diameter	Height-Centerline to top-maximum
			Minimum	Maximum
Inches	Inches	Inches	Inches	Inches
3/4	1	5	3-1/4	10
1	1-1/4	5-1/4	4	11
1-1/4	1-1/2	6	5	11-1/2
1-1/2	2	7	6	12-1/2
2	2-1/2	7-1/2	8	13-1/2
2-1/2	3	8	9	15-1/2
3	3-1/2	8-1/2	10	16-1/2
3-1/2	4	9	11	17-1/2
4	4-1/2	9-1/2	11	19
4-1/2	5	10	12	20-1/2
5	5-1/2	10-1/4	12	22
5-1/2	6	10-1/2	14	23-1/2
6	6-1/2	10-3/4	16	25
6-1/2	7	11	18	26-1/2
7	7-1/2	11-1/4	18	28
7-1/2	8	11-1/2	18	29-1/2
8	8-1/2	11-3/4	21	31
8-1/2	9	12	21	32-1/2
9	9-1/2	12-1/2	21	34
9-1/2	10	13	21	35-1/2
10	10-1/2	13-1/2	21	37

45V17(INT)

-7-

E-4b. The dimension of flanges shall conform to Bureau standard B-141, referred to in Section A.

E-4c. Materials shall be as follows:

(1) Oil Service.

Body, bonnet, stuffing box and gland - Class D cast steel (N.D. Specs. 49S1) or Class B forged steel (N.D. Specs. 49S2).

Disk and seat - CRS-1 corrosion-resisting steel (N.D. Specs. 46S18) or free machining cast corrosion-resisting steel (N.D. Specs. 46S27). The disk may be Class D cast steel (N.D. Specs. 49S1) fitted with seating face of either of the former materials.

Stem - CRS-7 corrosion-resisting steel (N.D. Specs. 46S18).

Stem nut, index unit and scale - brass.

Bolt-studs and nuts - steel, (N.D. Specs. 43B14).

Bolts and nuts - (N.D. Specs. 43B11).

(2) Air, Exhaust Steam or Water Services.

Body, bonnet and stuffing box - same materials as specified for "Oil Service".

Disk and seat - Gun metal (N.E. Specs. 43M6) or special composition of non-galling characteristics as approved.

Stem - nickel-copper alloy, rolled (N.E. Specs. 46M7).

Stuffing box gland, stem nut, index units and scale - brass.

Bolt-studs and nuts - steel (N.E. Specs. 43B14).

Bolt and nuts - (N.D. Specs. 43B11).

E-4d. Bonnets shall be flanged and bolted with bolt studs threaded full length and fitted with a nut on each end.

E-4e. Handwheels shall conform to Bureau standard B-64, referred to in Section A, and with diameters not less than those given in Table IV.

E-5. Class V Gate Valves.

E-5a. Valves shall have flanged ends and be made in all sizes and of the dimensions given in Table V.

45V17(INT)

TABLE V.

Size of Pipe or Tubing for which used	Dimensions			
	Diameter of Bore	Face to face over raised surface	Handwheel Diameter Minimum	Height Center- line to top - maximum
Inches	Inches	Inches	Inches	Inches
3/4	3/4	7-1/2	6	8-1/2
1	1	9-1/2	7	9-1/2
1-1/4	1-1/4	9	7	11
1-1/2	1-1/2	9-1/2	8	12-1/2
2	2	11-1/2	8	15
2-1/2	2-1/2	13	9	16-5/8
3	3	14	10	18-1/4
3-1/2	3-1/2	15	10	19
4	4	16	12	22
4-1/2	4-1/2	17	12	24
5	5	18	14	26
5-1/2	5-1/2	19	16	27-1/4
6	6	19-1/2	16	28-1/4
6-1/2	6-1/2	20-1/2	18	30
7	7	21-1/2	18	31
7-1/2	7-1/2	22-1/2	18	33
8	8	23-1/2	21	35
8-1/2	8-1/2	24-1/4	21	36
9	9	25	21	37
9-1/2	9-1/2	25-3/4	21	38
10	10	26-1/2	21	39

E-5b. The dimensions of flanges shall conform to Bureau drawings B-159 and B-530 referred to in Section A. Raised surfaces on all valve flanges shall be 1/4 inch in height.

E-5c. Materials shall be the same as specified for Class IV valves.

E-5d. Bonnets shall be bolted with bolt-studs threaded full length and fitted with a nut on each end.

E-5e. Handwheels shall conform to Bureau standard B-64, referred to in Section A, and with diameters not less than those given in Table V.

45V17(LMT)

-9-

E-6. Class VI Gate Valves.

E-6a. Valves shall have flanged ends and be made in all sizes and of the dimensions given in Table VI.

TABLE VI.

Size of pipe or tubing for which used	Dimensions				
	Diameter of bore	Face to face over raised surface	Handwheel Diameter, minimum	Height centerline to top - maximum	
Inches	Inches	Inches	Inches	Inches	
3/4	3/4	7-1/2	6	10-1/2	
1	1	8-1/2	7	11	
1-1/4	1-1/4	9	7	11-1/2	
1-1/2	1-1/2	9-1/2	8	13	
2	2	11-1/2	9	16-1/2	
2-1/2	2-1/2	13	9	17	
3	3	14	10	19	
3-1/2	3-1/2	15-1/2	12	19-1/2	
4	4	17	14	24	
4-1/2	4-1/2	13-1/2	14	26	
5	5	20	15	28	
5-1/2	5-1/2	21	18	29	
6	5	22	18	30-1/2	
6-1/2	6-3/8	23	21	32-1/2	
7	6-7/8	24	21	33-1/2	
7-1/2	7-3/8	25	21	35-1/2	
8	7-7/8	25	24	37-1/2	
8-1/2	8-3/8	27-1/4	24	38-1/2	
9	8-3/4	28-1/2	24	39-1/2	
9-1/2	9-1/4	29-3/4	24	40-1/2	
10	9-3/4	31	27	41-1/2	

E-6b. The dimensions of flanges shall conform to Bureau drawings B-174 and 3-S-550, referred to in Section A. Raised faces on all valves shall be 1/4-inch in height.

E-6c. Materials shall be the same as specified for Class IV valves.

E-6d. Bonnets shall be bolted with bolt-studs threaded full length and fitted with a nut on each end.

E-6e. Handwheels shall conform to Bureau standard B-64, referred to in Section A, and with diameters not less than those given in Table VI.

45V17(INT)

-10-

F. METHODS OF SAMPLING, INSPECTION AND TESTS.

F-1. Chemical and physical tests shall be made on samples of material taken during manufacture as required by the specifications covering the various materials used.

F-2. Each valve shall be inspected for defects of workmanship and compliance with specified dimensions.

F-3. Each valve shall be tested as follows:

- (a) By hydrostatic pressure, as tabulated below, for strength and porosity with the gate open.
- (b) By hydrostatic pressure, as tabulated below, for tightness on seat with the gate closed by hand and without the use of a wrench or equivalent, the pressure to be applied alternately on both sides of the gate with the side opposite the pressure open for inspection in each case.

Hydrostatic Test Pressures

	<u>(1) Open</u>	<u>(2) Closed</u>
Class I -----	150 lbs. per sq. in. gage	100 lbs. per sq. in. gage
Class II -----	300 lbs. per sq. in. gage	200 lbs. per sq. in. gage
Class III -----	600 lbs. per sq. in. gage	400 lbs. per sq. in. gage
Class IV -----	750 lbs. per sq. in. gage	400 lbs. per sq. in. gage
Class V -----	1000 lbs. per sq. in. gage	500 lbs. per sq. in. gage
Class VI -----	1500 lbs. per sq. in. gage	750 lbs. per sq. in. gage

F-4. The appliances for the hydrostatic testing of flanged valves shall not restrict longitudinal expansion.

G. PACKAGING, PACKING AND MARKING FOR SHIPMENT.

G-1. Packing.— Unless otherwise specified, valves shall be delivered in substantial commercial containers so constructed as to insure acceptance by common or other carrier for safe transportation at the lowest rate to the point of delivery.

G-2. Marking.— Unless otherwise specified, shipping containers shall be marked with the name of the material, the class, size and the quantity contained therein as defined by the contract or order under which shipment is made, the name of the contractor and the number of the contract or order.

-11-

H. NOTES.

H-1. Requisitions and contracts or orders should state the quantity of each class and the size of valves desired and the number of Type B and D drawings desired.

H-2. This specification supersedes Supplementary General Specification for Machinery, SGS(48)-20 formerly issued by the Bureau of Engineering, Navy Department, Washington, D. C.

H-3. Copies of Drawings and Specifications.--

H-3a. Copies of Drawings.-- Copies of Bureau of Engineering drawings may be obtained only upon application to the Bureau of Engineering, Navy Department, Washington, D. C. When requesting, refer to drawings by both title and number.

H-3b. Copies of Bureau of Engineering Specifications.-- Copies of Bureau of Engineering Specifications may be obtained only upon application to the Bureau of Engineering, Navy Department, Washington, D. C. When requesting, refer to Specification by both title and number.

H-3c. Copies of Navy Department Specifications.-- Copies of Navy Department Specifications may be obtained upon application to the Bureau of Supplies and Accounts, Navy Department, Washington, D. C. When requesting, refer to specification by both title and number.

15 January 1938

45V19(INT)

BUREAU OF ENGINEERING SPECIFICATION

VALVES, HIGH PRESSURE, GLOBE AND ANGLE, FORGED STEEL, WELDING ENDS,

SIZES, 1/4-INCH TO 1-INCH INCLUSIVE

600 Lbs. W.S.P. and 850°F. Maximum Temperature

(Shipboard Use)

A. APPLICABLE SPECIFICATIONS AND DRAWINGS.

A-1. The following specifications, of the issue in effect on date of invitation for bids, form a part of this specification, and bidders and contractors should provide themselves with the necessary copies.

NAVY DEPARTMENT SPECIFICATIONS

General Specifications for Inspection of Material, together with Appendix II (Metals).

- 42N2 - Nameplates, instruction plates, and other designating markings for electrical and mechanical equipment (shipboard use).
- 42S5 - Screws, machine.
- 43B11 - Bolts, nuts, studs, and tap rivets (and material for same).
- 43B14 - Bolt studs, steel rods and nuts for service at temperatures up to 850°F.
- 45V18 - Valves, high pressure, globe and angle, steel (Shipboard use).
- 46A1 - Aluminum alloy, light castings.
- 46B6 - Brass, naval, rolled: bars, plates, etc.
- 46B10 - Brass, naval: castings.
- 46-I-8 - Iron, malleable: castings.
- 46M6 - Metal, gun: castings.
- 46M7 - Nickel-copper alloy, rolled.
- 46F1 - Plating, cadmium.
- 46R5 - Rods, welding, cobalt-chromium composition.
- 46S18 - Steel, corrosion-resisting; bars, rods and forgings (except for reforging)
- 46S33 - Steel castings, molybdenum alloy (for temperatures up to 850°F.).
- 46S34 - Steel forgings, molybdenum alloy (for temperatures up to 850°F.).
- 49S1 - Steel: castings.
- 49S2 - Steel: forgings for hulls, engines, ordnance.

BUREAU OF ENGINEERING SPECIFICATIONS

General Specifications for Machinery, Subsection SI-1.

A-2. The following Bureau of Engineering drawings, of the latest alteration in effect on date of invitation for bids, form a part of this specification, and bidders and contractors should provide themselves with the necessary copies:

- B-64 - Handwheels for valves.
- B-100 - Finish marks.
- B-147 - Seamless drawn steel tubing.
- B-153 - Standard application of annual contract packing.
- 3-S-530 - Forged steel welding and fittings.

45V19(INT)

-3-

B. TYPE.

B-1. Valves covered by this specification shall be furnished in but one type.

C. MATERIAL AND WORKMANSHIP.

C-1. Departures from Referenced Specifications.-- The use of materials differing from the referenced Navy Department specifications will be considered when it can be clearly demonstrated that an improvement in operating characteristics, or a saving in weight without sacrifice in reliability can be accomplished thereby, or that such substitutes do not preclude the subsequent use of Navy standard materials in effecting repairs or replacements necessitated by service wear. Specific approval shall be obtained where departures are made from the referenced specifications.

C-2. Materials.-- All materials used in the construction of valves shall be as specified in Section E. Alternate materials will be considered in lieu of those specified but their use will only be permitted after the Bureau has been satisfied by test or other means that the proposed substitutes fully meet the service requirements.

C-3. Threaded Parts; Standard Bolts, Nuts and Machine Screws.-- Bolts and nuts shall conform to U.D. Specs. 43B11 or 43B14, referred to in Section A, as applicable. All threaded parts shall be assembled with the use of a suitable high temperature thread lubricant satisfactory to the Bureau.

C-4. Workmanship.-- All parts shall be free from flaws, burrs, and blemishes. The workmanship shall be first class in every respect.

D. GENERAL REQUIREMENTS.

D-1. (See Section E).

E. DETAIL REQUIREMENTS.

E-1. Plans.-- Plans shall be furnished as required by the bureau concerned.

E-1a. Bureau of Engineering.

E-1a(1). The number, size, arrangement, title, form, etc., shall conform to the requirements of Subsection SI-1, referred to in Section A.

E-1a(3). The specific plans desired, except as provided by subparagraphs E-1a(3) and E-1a(4), shall include the following:

Type A.
Type B.
Type D.

45V10(IHT)

-3-

E-1a(3). Type A drawings shall accompany bids, except when the bidder has filed with the Bureau approved drawings of the valves, in which case it will suffice to quote the Bureau file numbers of the drawings for identification that the valves have been approved by the Bureau and meet these specifications.

E-1a(4). Type B and Type D drawings will not be required provided the contractor has filed with the Bureau approved drawings of the valves.

E-2. The materials shall conform to the following:

- (a) Body and bonnet.- Class A forged carbon-molybdenum steel (N.D. Specs. 46S34),
- (b) Bonnet bolt-studs and nuts.- Steel (N.D. Spec. 43B14),
- (c) Bonnet yoke bushing.- Gun metal (N.D. Spec. 46M6),
- (d) Bonnet gasket.- Soft steel or iron sheet; nickel-copper alloy sheet, (N.D. Spec. 46M7), dead soft annealed; or copper-nickel zinc sheet of approximately 64 percent copper, 30 percent nickel and 6 percent zinc. Brinell 80 or less for all.
- (e) Disk.- Cast carbon-molybdenum steel, (N.D. Spec. 46S33) or forged carbon-molybdenum steel (N.D. Spec. 46S34); (see item g for seating face).
- (f) Disk nut.- Forged steel, Class C (N.D. Spec. 49S2).
- (g) Disk and seat, seating faces.- Cobalt-chromium composition (N.D. Spec. 46R5).
- (h) Flange bolt - studs and nuts.- (Bureau Standard Sheet B-174).
- (i) Gland, stuffing box.- Class C cast of forged steel (electro-galvanized) (N.D. Spec. 49S1 or 49S2)
- (j) Gland bolts.- Steel, Class B (N.D. Spec. 43B11), cadmium plated (N.D. Spec. 46P1); nuts - steel, Class C (N.D. Spec. 43B11), cadmium plated (N.D. Spec. 46P1); or Naval brass (N.D. Spec. 46B6).
- (k) Handwheels.- See Bureau Standard Sheet B-64.
- (l) Lock washer for disk nut.- Corrosion-resisting steel, Grade 1, (N.D. Spec. 47S20).
- (m) Set screws and split pins.- Steel.
- (n) Stem bushing.- Special nickel-copper alloy, 52 to 56 percent nickel, 30.5 to 34 percent copper, 10.5 to 13 percent tin, 0.35 to 1 percent silicon, 0.30 to 0.75 percent manganese, 0.40 to 1 percent phosphorous and 1 to 2 percent iron. Minimum tensile strength 60,000 pounds per square inch. Brinell 190 to 235. Other materials satisfactory for the service will be given consideration.
- (o) Stem for disk.- Forged corrosion-resisting steel, grade 7, (N.D. Spec. 46S18)
- (p) Stem nuts.- Naval brass (N.D. Spec. 46B6).
- (q) Washer between end of rotating stem and disk.- Nitralloy or equivalent, at least 800 Brinell hardness.
- (r) T-handles.- Naval brass (N.D. Spec. 46B1C), or malleable iron (N.D. Spec. 46-I-8).

E-3. Valves shall be so designed as to insure positive tightness under severe service.

E-4. The bodies of all valves shall be so fitted that the valves may be easily ground in.

45V19(INT)

-4-

E-5. The characteristic dimensions of all valves shall be as given in Figure 1.

E-6. Bodies and bonnets shall be forged.

E-7. The unrestricted area through the seats, with the disk in the full open position, and through all body passages, shall be not less than that given in column "B" of the table shown on Figure 1.

E-8. Valves shall have bolted bonnets. The joint faces for bonnet flanges shall be male and female and shall have (f2) finish; see Bureau Standard Sheet B-100, referred to in Section A. The bonnets shall be secured by studs or bolt-studs.

E-9. Yokes shall be integral with the bonnets, but a design with separate yoke will be given consideration. The yoke shall be fitted with a bushing threaded to suit the stem.

E-10. Stems shall have outside Acme type of threads unless otherwise approved, and shall turn right-hand to close the valves.

E-11. Valve disks shall be of the plug type with swivel attachment to the stems and the seating area faced with cobalt-chromium composition not less than 3/32-inch thick for 1-inch and 3/4-inch valves, and 1/16-inch thick for valves 1/2-inch and smaller; the composition to be deposited by welding to insure positive bond between it and the disk. Disks shall be secured to the stems by nuts locked in place; other means for securing disks for 1/4-inch and 3/8-inch valves will be considered if the method is described in the bid. A hardened washer shall be inserted between the end of all stems and disks for valves 3/4-inch and larger to prevent galling.

E-12. Valve seats shall be integral with the bodies. The seating area shall be faced with cobalt-chromium composition in compliance with similar requirements for the disks; see paragraph E-11. The included seat angle shall be 30 to 60 degrees.

E-13. Stuffing boxes shall be of ample depth for at least six turns of packing, except 1/4-inch valves which shall have at least four turns. Stuffing boxes shall be arranged so that they can be packed when under pressure with the valve open. Valves shall be delivered with stuffing boxes suitably packed. The packing shall be as approved; see Bureau Standard Sheet B-153, referred to in Section A. Stuffing box glands shall be secured and adjusted by studs, and nuts.

E-14. Handwheels.— Handwheels shall conform to Bureau Standard Sheet B-64, referred to in Section A. The minimum diameters shall be as given in the table shown on Figure 1. All handwheels shall have the rims and the upper face of hubs finished and buffed and the spokes and unfinished portion of the hubs wire brushed, unless required to be finished and buffed all over. All handwheels shall be secured by means of a hexagonal nut threaded to the stem. T-handles may be used instead of handwheels for 1/4-inch and 3/8-inch valves.

E-15. Each valve shall have distinctly stamped, or equivalent, on one side of the body, the "size", "E.P.", "600", and in the case of globe valves, the position of the seat, for identification. The manufacturers trade mark may also appear on the body. When space does not permit this, the marking shall be as directed.

45V19(IMP)

-5-

F. METHODS OF SAMPLING, INSPECTION AND TESTS.

F-1. Chemical and physical tests shall be made as required by the specifications covering the various materials used.

F-2. Five percent of the initial quantity of valves on order for any new design shall be selected by the Naval Inspector and tested to a steam pressure of 600 pounds per square inch gage, at a temperature of 850°F. Such test shall include tests for tightness on both sides of the disk, and tightness of the body. On subsequent cumulative orders, on the same manufacturer for valves of the same design a total of five percent of each size of valve so ordered shall be given the above steam test. This shall be interpreted to mean that of each one hundred valves of the same size and design ordered, the Inspector may select at his discretion five valves to be steam tested. Valves so selected may be taken from one order or from a multiplicity of orders totalling one hundred valves as desired, the number tested being a percentage of the total runs of valves and not a percentage of each individual order.

F-3. All valves shall be tested as follows:

- (a) By hydrostatic pressure to at least 1500 pounds per square inch for strength and porosity with the disk open.
- (b) By hydrostatic pressure to at least 750 pounds per square inch for tightness on seat with the disk closed by hand and without the use of a wrench or equivalent, the pressure shall be applied alternately on both sides of the disk with the side opposite the pressure open for inspection in each case.
- (c) By air pressure to approximately 100 pounds per square inch for porosity and tightness on seat, procedure to be as outlined in (b) above.

G. PACKAGING, PACKING, AND MARKING FOR SHIPMENT.

G-1. Packing.— Unless otherwise specified, the subject commodity shall be delivered in substantial wooden crates or boxes, so constructed as to insure safe delivery by common or other carrier to the point of delivery. Not more than five valves shall be packed in a container. The valves shall be packed rigidly, or secured in the containers in such a manner as will prevent damage from shifting while being handled or transported. Sets of spare parts, if furnished, shall be packaged or bagged, and secured to the valve to which they belong.

G-2. Marking.— Unless otherwise specified, shipping containers shall be marked with the name of the material, the type, size, and the quantity contained therein as defined by the contract or order under which the shipment is made, the name of the contractor, and the number of the contract or order, and the net and gross weight.

45V19(INT)

-6-

H. NOTES.

H-1. Requisitions and contracts or orders should state the number of Type B and D drawings desired. See subparagraphs E-1a(3) and E-1a(4).

H-2. This specification supersedes Supplementary General Specification for Machinery, SGS(48)-155 formerly issued by the Bureau of Engineering, Navy Department, Washington, D.C.

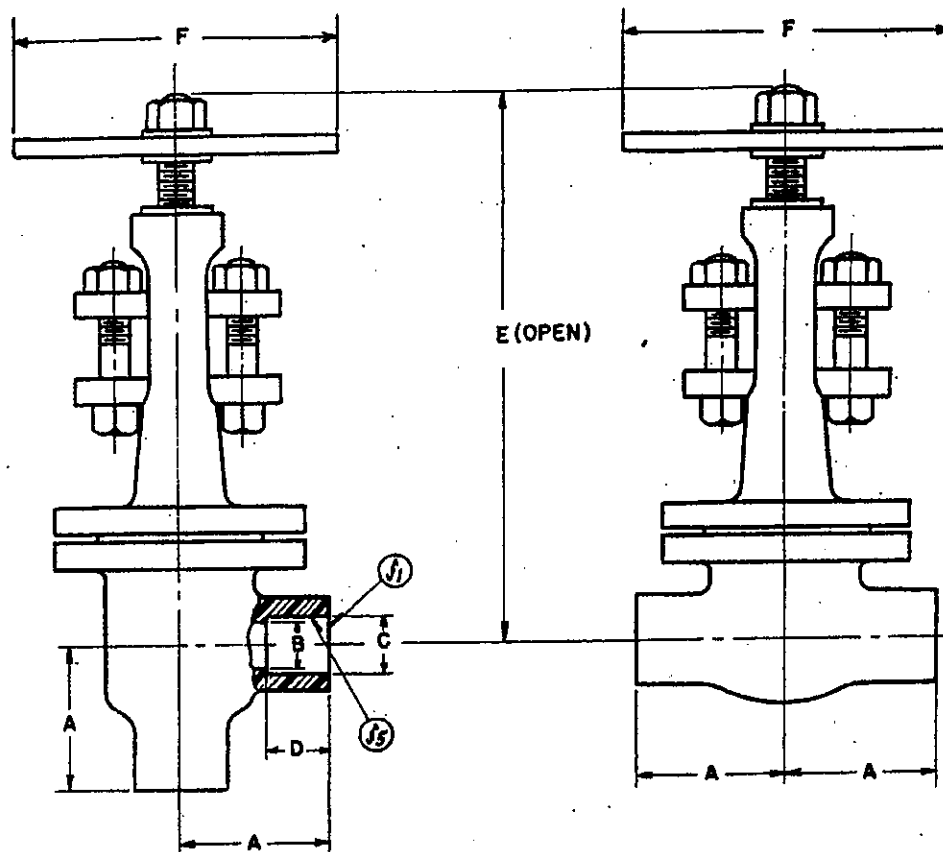
H-3. Copies of Drawings and Specifications.

H-3a. Copies of Drawings.- Copies of Bureau of Engineering drawings may be obtained only upon application to the Bureau of Engineering, Navy Department, Washington, D.C. When requesting, refer to drawings by both title and number.

H-3b. Copies of Bureau of Engineering Specifications.- Copies of Bureau of Engineering specifications may be obtained only upon application to the Bureau of Engineering, Navy Department, Washington, D.C. When requesting, refer to specification by both title and number.

H-3c. Copies of Navy Department Specifications.- Copies of Navy Department specifications may be obtained upon application to the Bureau of Supplies and Accounts, Navy Department, Washington, D.C., except that naval activities should make application to the Commandant, Navy Yard, New York, N.Y. When requesting, refer to specification by both title and number.

45 V/9



ALL DIMENSIONS IN INCHES							
SIZE	A	B	C	D	E		F
					GLOBE	ANGLE	
$\frac{1}{4}$	2	$\frac{5}{16}$	.55	$\frac{7}{16}$	6	$5\frac{5}{8}$	*3
$\frac{3}{8}$	$2\frac{1}{8}$	$\frac{7}{16}$	.685	$\frac{9}{16}$	$6\frac{1}{4}$	$5\frac{7}{8}$	*4
$\frac{1}{2}$	$2\frac{5}{16}$	$\frac{19}{32}$	.855	$\frac{5}{8}$	$7\frac{3}{8}$	$6\frac{3}{4}$	5
$\frac{3}{4}$	$2\frac{7}{8}$	$\frac{3}{16}$	1.07	$\frac{11}{16}$	$9\frac{1}{8}$	$8\frac{1}{8}$	6
1	$3\frac{1}{2}$	$\frac{1}{16}$	1.335	$\frac{3}{4}$	11	$9\frac{5}{8}$	7

*MINIMUM LENGTH OF TEE HANDLES $2\frac{1}{2}$ INCHES AND 4 INCHES, RESPECTIVELY.

FIG. 1

10 November 1937

45V19(12T)

BUREAU OF ENGINEERING SPECIFICATIONS

VALVES, HIGH PRESSURE, GLOBE AND ANGLE, FORGED STEEL, WELDING ENDS,

SIZES, 1/4-INCH TO 1-INCH INCLUSIVE

600 Lbs. W.S.P. and 850° F. Maximum Temperature

(SHIPBOARD USE)

A. APPLICABLE SPECIFICATIONS AND DRAWINGS.

A-1. The following specifications, of the issue in effect on date of invitation for bids, form a part of this specification, and bidders and contractors should provide themselves with the necessary copies.

NAVY DEPARTMENT SPECIFICATIONS

General Specifications for Inspection of Material, together with
Appendix II (Metals).

- 42S5 - Screws, machine.
- 43R11 - Bolts, nuts, studs and tap rivets (and material for same).
- 43R14 - Bolt studs, steel rods and nuts for service at temperatures up to 850°F.
- 45V18 - Valves, high pressure, globe and angle, steel (Shipboard use).
- 46A1 - aluminum alloy, light castings.
- 46B6 - Brass, naval, rolled: Bars, plates, etc.
- 46B10 - Brass, naval: Castings.
- 46-I-8 - Iron, malleable: Castings.
- 46M6 - Metal, gun: Castings.
- 46M7 - Nickel-copper alloy, rolled.
- 46P1 - Plating, cadmium.
- 46R5 - Rods, welding, cobalt-chromium composition.
- 46S18 - Steel, corrosion-resisting; bars, rods and forgings (except for reforging)
- 46S33 - Steel castings, molybdenum alloy (for temperatures up to 850° F.).
- 46S34 - Steel forgings, molybdenum alloy (for temperatures up to 850° F.).
- 49S1 - Steel: Castings.
- 49S2 - Steel: Forgings for hulls, engines, and ordnance.

BUREAU OF ENGINEERING SPECIFICATIONS

General Specifications for Machinery, Subsection S1-1.

A-2. The following Bureau of Engineering drawings, of the latest alteration in effect on date of invitation for bids, form a part of this specification, and bidders and contractors should provide themselves with the necessary copies:

- B-64 - Handwheels for valves.
- B-100- Finish marks.
- B-147- Seamless drawn steel tubing.
- B-153- Standard application of annual contract packing.
- 3-S-530- Forged steel welding end fittings.

45V19(INT)

-3-

B. TYPE.

B-1. Valves covered by this specification shall be furnished in but one type.

C. MATERIAL AND WORKMANSHIP.

C-1. Departures from Referenced Specifications.-- The use of materials differing from the referenced Navy Department specifications will be considered when it can be clearly demonstrated that an improvement in operating characteristics, or a saving in weight without sacrifice in reliability can be accomplished thereby, or that such substitutes do not preclude the subsequent use of Navy standard materials in effecting repairs or replacements necessitated by service wear. Specific approval shall be obtained where departures are made from the referenced specifications.

C-2. Materials.-- All materials used in the construction of valves shall be as specified in Section E. Alternate materials will be considered in lieu of those specified but their use will only be permitted after the Bureau has been satisfied by test or other means that the proposed substitutes fully meet the service requirements.

C-3. Threaded Parts; Standard Bolts, Nuts and Machine Screws.-- Bolts and nuts shall conform to U.S. Specs. 43311 or 43314, referred to in Section A, as applicable. All threaded parts shall be assembled with the use of a suitable high temperature thread lubricant satisfactory to the Bureau.

C-4. Workmanship.-- All parts shall be free from flaws, burrs, and blemishes. The workmanship shall be first class in every respect.

D. GENERAL REQUIREMENTS.

D-1. (See Section E).

E. DETAIL REQUIREMENTS.

E-1. Plans.-- Plans shall be furnished as required by the bureau concerned.

E-1a. Bureau of Engineering.

E-1a(1). The number, size, arrangement, title, form, etc., shall conform to the requirements of Subsection SI-1, referred to in Section A.

E-1a(2). The specific plans desired, except as provided by subparagraphs E-1a(3) and E-1a(4), shall include the following:

Type A.
Type B.
Type C.

45V19(INT)

-3-

E-1a(3). Type A drawings shall accompany bids, except when the bidder has filed with the Bureau approved drawings of the valves, in which case it will suffice to quote the Bureau file numbers of the drawings for identification that the valves have been approved by the Bureau and meet these specifications.

E-1a(4). Type B and Type D drawings will not be required provided the contractor has filed with the Bureau approved drawings of the valves.

E-2. The materials shall conform to the following:

- (a) Body and bonnet.- Class A forged carbon-molybdenum steel (N.D. Specs. 46S34).
- (b) Bonnet bolt-studs and nuts.- Steel (N.D. Spec. 43B14).
- (c) Bonnet yoke bushing.- Gun metal (N.D. Spec. 46L6).
- (d) Bonnet gasket.- Soft steel or iron sheet; nickel-copper alloy sheet, (N.D. Spec. 46M7), dead soft annealed; or copper-nickel zinc sheet of approximately 64 percent copper, 30 percent nickel and 6 percent zinc. Brinell 80 or less for all.
- (e) Disk.- Cast carbon-molybdenum steel, (N.D. Spec. 46S33) or forged carbon-molybdenum steel (N.D. Spec. 46S34); (see item 7 for seating face).
- (f) Disk nut.- Forged steel, Class C (N.D. Spec. 49S2).
- (g) Disk and seat, seating faces.- Cobalt-chromium composition (N.D. Spec. 46R5).
- (h) Flange bolt - studs and nuts.- (Bureau Standard Sheet B-174).
- (i) Gland, stuffing box.- Class C cast or forged steel (electro-galvanized) (N.D. Spec. 49S1).
- (j) Gland bolts.- Steel, Class B (N.D. Spec. 43B11), cadmium plated (N.D. Spec. 46P1); nuts - steel, Class C (N.D. Spec. 43B11), cadmium plated (N.D. Spec. 46P1); or Naval brass (N.D. Spec. 46B6).
- (k) Handwheels.- See Bureau Standard Sheet B-64.
- (l) Lock washer for disk nut.- Corrosion-resisting steel, Grade 1, (N.D. Spec. 46S18).
- (m) Set screws and split pins.- Steel.
- (n) Stem bushing.- Special nickel-copper alloy, 52 to 56 percent nickel, 30.5 to 34 percent copper, 10.5 to 13 percent tin, 0.35 to 1 percent silicon, 0.30 to 0.75 percent manganese, 0.40 to 1 percent phosphorous and 1 to 2 percent iron. Minimum tensile strength 60,000 pounds per square inch. Brinell 190 to 235. Other materials satisfactory for the service will be given consideration.
- (o) Stem for disk.- Forged corrosion-resisting steel, grade 7, (N.D. Spec. 46S18).
- (p) Stem nuts.- Naval brass (N.D. Spec. 46B6).
- (q) Washer between end of rotating stem and disk.- Nitralloy or equivalent, at least 80C Brinell hardness.
- (r) T-handles.- Naval brass (N.D. Spec. 46B1C), or malleable iron (N.D. Spec. 46-I-8).

E-3. Valves shall be so designed as to insure positive tightness under severe service.

E-4. The bodies of all valves shall be so fitted that the valves may be easily ground in.

45V19(INT)

-4-

E-5. The characteristic dimensions of all valves shall be as given in Figure 1.

E-6. Bodies and bonnets shall be forged.

E-7. The unrestricted area through the seats, with the disk in the full open position, and through all body passages, shall be not less than that given in column "B" of the table shown on Figure 1.

E-8. Valves shall have bolted bonnets. The joint faces for bonnet flanges shall be male and female and shall have (f9) finish; see Bureau Standard Sheet B-10C, referred to in Section A. The bonnets shall be secured by studs or bolt-studs.

E-9. Yokes shall be integral with the bonnets, but a design with separate yoke will be given consideration. The yoke shall be fitted with a bushing threaded to suit the stem.

E-10. Stems shall have outside Acme type of threads unless otherwise approved, and shall turn right-hand to close the valves.

E-11. Valve disks shall be of the plug type with swivel attachment to the stems and the seating area faced with cobalt-chromium composition not less than 3/32-inch thick for 1-inch and 3/4-inch valves, and 1/16 inch thick for valves 1/2-inch and smaller; the composition to be deposited by welding to insure positive bond between it and the disk. Disks shall be secured to the stems by nuts locked in place; other means for securing disks for 1/4-inch and 3/8-inch valves will be considered if the method is described in the bid. A hardened washer shall be inserted between the end of all stems and disks for valves 3/4-inch and larger to prevent galling.

E-12. Valve seats shall be integral with the bodies. The seating area shall be faced with cobalt chromium composition in compliance with similar requirements for the disks; see paragraph E-11. The included seat angle shall be 30 to 60 degrees.

E-13. Stuffing boxes shall be of ample depth for at least six turns of packing, except 1/4-inch valves which shall have at least four turns. Stuffing boxes shall be arranged so that they can be packed when under pressure with the valve open. Valves shall be delivered with stuffing boxes suitably packed. The packing shall be as approved; see Bureau Standard Sheet B-153, referred to in Section A. Stuffing box glands shall be secured and adjusted by studs, and nuts.

E-14. Handwheels.— Handwheels shall conform to Bureau Standard Sheet B-64, referred to in Section A. The minimum diameters shall be as given in the table shown on Figure 1. All handwheels shall have the rims and the upper face of hubs finished and buffed and the spokes and unfinished portion of the hubs wire brushed, unless required to be finished and buffed all over. All handwheels shall be secured by means of a hexagonal nut threaded to the stem. T-handles may be used instead of handwheels for 1/4-inch and 3/8-inch valves.

45V19(INT)

-5-

F. METHODS OF SAMPLING, INSPECTION AND TESTS.

F-1. Chemical and physical tests shall be made as required by the specifications covering the various materials used.

F-2. Five percent of the initial quantity of valves on order for any new design shall be selected by the Naval Inspector and tested to a steam pressure of 600 pounds per square inch gage, at a temperature of 850°F. Such test shall include tests for tightness on both sides of the disk, and tightness of the body. On subsequent cumulative orders, on the same manufacturer for valves of the same design a total of five percent of each size of valve so ordered shall be given the above steam test. This shall be interpreted to mean that of each one hundred valves of the same size and design ordered, the Inspector may select at his discretion five valves to be steam tested. Valves so selected may be taken from one order or from a multiplicity of orders totalling one hundred valves as desired, the number tested being a percentage of the total runs of valves and not a percentage of each individual order.

F-3. All valves shall be tested as follows:

- (a) By hydrostatic pressure to at least 1500 pounds per square inch for strength and porosity with the disk open.
- (b) By hydrostatic pressure to at least 750 pounds per square inch for tightness on seat with the disk closed by hand and without the use of a wrench or equivalent, the pressure shall be applied alternately on both sides of the disk with the side opposite the pressure open for inspection in each case.
- (c) By air pressure to approximately 100 pounds per square inch for porosity and tightness on seat, procedure to be as outlined in (b) above.

G. PACKAGING, PACKING, AND MARKING FOR SHIPMENT.

G-1. Packing.-- Unless otherwise specified, the subject commodity shall be delivered in substantial wooden crates or boxes, so constructed as to insure safe delivery by common or other carrier to the point of delivery. Not more than five valves shall be packed in a container. The valves shall be packed rigidly, or secured in the containers in such a manner as will prevent damage from shifting while being handled or transported. Sets of spare parts, if furnished, shall be packaged or bagged, and secured to the valve to which they belong.

G-2. Marking.-- Unless otherwise specified, shipping containers shall be marked with the name of the material, the type, size, and the quantity contained therein as defined by the contract or order under which the shipment is made, the name of the contractor, and the number of the contract or order, and the net and gross weight.

45V19(IIT)

-6-

H. NOTES.

H-1. Requisitions and contracts or orders should state the number of Type B and D drawings desired. See subparagraphs E-1a(3) and E-1a(4).

H-2. This specification supersedes Supplementary General Specification for Machinery, SGS(48)-155 formerly issued by the Bureau of Engineering, Navy Department, Washington, D.C.

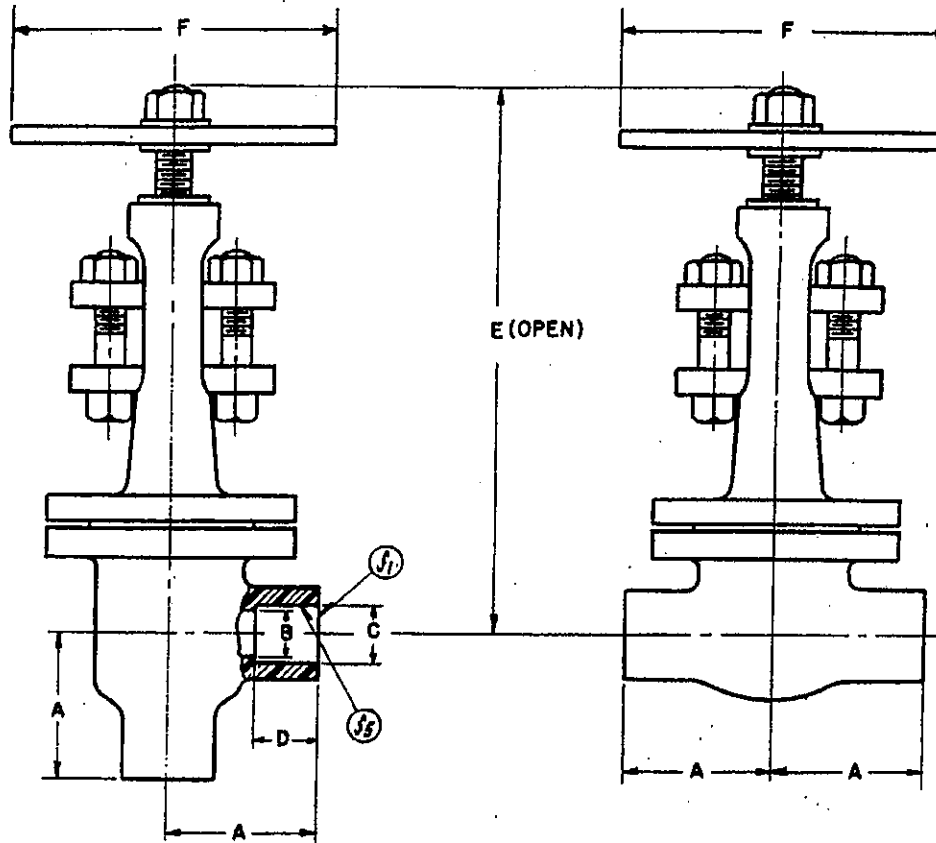
H-3. Copies of Drawings and Specifications.

H-3a. Copies of Drawings.- Copies of Bureau of Engineering drawings may be obtained only upon application to the Bureau of Engineering, Navy Department, Washington, D.C. When requesting, refer to drawings by both title and number.

H-3b. Copies of Bureau of Engineering Specifications.- Copies of Bureau of Engineering specifications may be obtained only upon application to the Bureau of Engineering, Navy Department, Washington, D.C. When requesting, refer to specification by both title and number.

H-3c. Copies of Navy Department Specifications.- Copies of Navy Department specifications may be obtained upon application to the Bureau of Supplies and Accounts, Navy Department, Washington, D.C., except that naval activities should make application to the Commandant, Navy Yard, New York, N.Y. When requesting, refer to specification by both title and number.

45 V/9



ALL DIMENSIONS IN INCHES							
SIZE	A	B	C	D	E		F
					GLOBE	ANGLE	
$\frac{1}{4}$	2	$\frac{5}{16}$	.55	$\frac{7}{16}$	6	$5\frac{5}{8}$	*3
$\frac{3}{8}$	$2\frac{1}{8}$	$\frac{7}{16}$	.685	$\frac{9}{16}$	$6\frac{1}{4}$	$5\frac{7}{8}$	*4
$\frac{1}{2}$	$2\frac{5}{16}$	$\frac{19}{32}$	.855	$\frac{5}{8}$	$7\frac{3}{8}$	$6\frac{3}{4}$	5
$\frac{3}{4}$	$2\frac{7}{8}$	$\frac{13}{16}$	1.07	$\frac{11}{16}$	$9\frac{1}{8}$	$8\frac{1}{8}$	6
1	$3\frac{1}{2}$	$1\frac{1}{16}$	1.335	$\frac{3}{4}$	11	$9\frac{5}{8}$	7

*MINIMUM LENGTH OF TEE HANDLES $2\frac{1}{2}$ INCHES AND 4 INCHES, RESPECTIVELY.

FIG. 1

MIL-V-22052D(SH)
20 March 1978
~~SUPERSEDED~~
MIL-V-22052C(SHIPS)
11 April 1961
(See 4.5)

MILITARY SPECIFICATION

VALVES, STOP AND STOP CHECK, GLOBE, ANGLE, AND Y PATTERN, CAST OR
FORGED CARBON OR ALLOY STEEL, OUTSIDE SCREW AND YOKE
(SIZE 2-1/2 INCHES AND LARGER)

This specification is approved for use by the Naval Sea Systems Command and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers steel globe, angle, and Y pattern valves in sizes 2-1/2 inches and larger.

1.2 Classification. Valves shall be classified in accordance with the composition and rating (see 1.2.1 and 1.2.2), as specified (see 4.2.1).

1.2.1 Composition. Valves shall be of the following compositions:

Composition A:
Chromium - 2-1/4 percent.
Molybdenum - 1 percent.
Composition B:
Chromium - 1-1/4 percent.
Molybdenum - 1/2 percent.
Composition C:
Carbon steel.

1.2.2 Rating. Valves shall be rated as standard (150, 300, or 600 class), and as special (600, 900, 1500, or 2500 class) in accordance with ANSI B16.34.

2. APPLICABLE DOCUMENTS

2.1 Issues of documents. The following documents, of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

SPECIFICATIONS

FEDERAL

WM-P-46 - Packing; Asbestos, Sheet, Compressed.

MILITARY

MIL-V-3 - Valves, Fittings, and Flanges (Except for Systems Indicated Herein); Packaging of.

MIL-R-196 - Repair Parts for Internal Combustion Engines, Packaging of.

MIL-S-901 - Shock Tests, H.I. (High-Impact); Shipboard Machinery, Equipment and Systems, Requirements for.

MIL-F-1541 - Fittings, Lubrication.

MIL-A-7021 - Asbestos Sheet, Compressed, for Fuel, Lubricant, Coolant, Water, and High Temperature Resistant Gaskets.

MIL-R-17131 - Rods and Powders, Welding, Surfacing.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Naval Ship Engineering Center, SEC 6134, Department of the Navy, Washington, DC 20362 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

MIL-V-220520(ISH)

MILITARY (Continued)

- MIL-P-17303 - Packing Materials, Plastic Metallic and Plastic Nonmetallic.
- MIL-G-21032 - Gaskets, Metallic-Asbestos, Spiral Wound.
- MIL-V-22094 - Valves, Globe, Y-Pattern Globe, Stop Check, Angle, Flanged Bonnet, Manually Operated Nominal Pipe Size (NPS), 2 inches and Less.
- MIL-P-24377 - Packing Material, Asbestos, Braided, Impregnated With TFE (Polytetrafluoroethylene). Surface Lubricated.

STANDARDS

MILITARY

- MIL-STD-167-1 - Mechanical Vibrations of Shipboard Equipment (Type I - Environmental and Type II - Internally Excited).
- MIL-STD-271 - Nondestructive Testing Requirements for Metals.
- MIL-STD-278 - Fabrication Welding and Inspection; and Casting Inspection and Repair for Machinery, Piping and Pressure Vessels in Ships of the United States Navy.
- MIL-STD-798 - Nondestructive Testing, Welding, Quality Control, Material Control and Identification and Hi-Shock Test Requirements for Piping System Components for Naval Shipboard Use.
- MIL-STD-1552 - Provisioning Technical Documentation, Uniform DOD Requirements for.
- MIL-STD-1561 - Provisioning Procedures, Uniform DOD.
- MS15003 - Fittings, Lubrication (Hydraulic); Surface Check, 1/8 Pipe Threads.

DRAWINGS

MILITARY

- NAVSHIPS 5000-84824-1385620 - Handwheels for Valves.
- NAVSEA 803-5001021 - Pressure Seal Ring-Standard and Oversize-Valve Pressure Class 690-1500.

(Copies of specifications, standards, drawings, and publications required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- B16.10 - Face-to-Face and End-to-End Dimensions of Ferrous Valves.
- B16.34 - Steel Nutt-Welding End Valves.

(Application for copies should be addressed to the American National Standards Institute, 1430 Broadway, New York, New York 10018.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- A105 - Forgings, Carbon Steel, for Piping Components.
- A106 - Seamless Carbon Steel Pipe for High-Temperature Service.
- A182 - Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.
- A193 - Alloy-Steel and Stainless Steel, Bolting Materials for High-Temperature Service.
- A194 - Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service.
- A216 - Carbon-Steel Castings Suitable for Fusion Welding for High-Temperature Service.
- A217 - Martensitic Stainless Steel and Alloy Steel Castings for Pressure-Containing Parts Suitable for High-Temperature Service.
- A335 - Seamless Ferritic Alloy Steel Pipe for High-Temperature Service.

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.)

(Technical society and technical association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

MIL-V-22032D(SH)

1. REQUIREMENTS

1.1 Qualification. Valves with a 600, 900, 1500, or 2500 special class rating, furnished under this specification shall be products which are qualified for listing on the applicable qualified products list at the time set for opening of bids (see 4.3 and 6.3).

1.2 Materials. Materials shall be as specified in table I. Materials for parts other than those listed in table I shall be selected so as to prevent galling, seizing, or excessive wear of operating parts. Cast iron and aluminum shall be used only for those parts where permitted in this specification. Magnesium alloys shall not be used. Clearances shall be adequate to prevent interferences due to thermal expansion.

TABLE I. List of materials.

Name of parts	Materials form	Composition A	Composition B	Composition D
		Applicable documents		
Body, bonnet	Forgings or castings	ASTM A182, grade F22 ASTM A317, grade WC9	ASTM A182, grade F11 ASTM A217, grade WC6	ASTM A105, ASTM A216, grade WC1 ^{1/}
Retaining ring and yoke	Forgings or castings	ASTM A182, grades F22 or F11 ASTM A105 ASTM A217, grades WC9 or WC6 ASTM A216, grade WC6		
Studs for bonnets	Alloy steel for high temperature bolting	ASTM A193, grade B16	ASTM A193, grade B16	ASTM A193, grades B7 and B16
Nuts for bonnets	Heavy semi-finished hexagon carbon and alloy steel for high temperature bolting	ASTM A194, grade 4	ASTM A194, grade 4	ASTM A194, grades 2H and 4
Standard pressure seal rings and standard oversized pressure seal rings ^{2/}	Soft carbon steel, silver-plated	Commercial		
Gaskets (for flanged bonnets)	Spiral wound	MIL-G-21032, type 2, class A or B		
	Compressed asbestos sheet	MIL-A-7021 (where fuel resistance is necessary) MIL-P-46, class 1 (except where fuel resistance is necessary)		
Packing	Asbestos impregnated with polytetrafluoroethylene	MIL-P-24377 (nonlubricated) service temperature not to exceed that of saturated steam MIL-P-24377, superheated steam total temperature in excess of 550°F		
	Plastic, metallic or nonmetallic	MIL-P-17303, symbol 1111 for temperatures above 500°F		
Nuts, bolts, washers, bushings, liners	Materials used in the construction of these parts other than specified above shall be in accordance with the material specifications shown on the manufacturer's drawings (see 3.6.1)			
Valve trim	(See table IV)			

^{1/} Bonnet material for composition D valves may also be grade WC6 of ASTM A317.

^{2/} Oversized seal rings may be used in the repair of pressure seal bonnets, (i.e.) as shown on Drawing 803-5001021.

MIL-V-27052D(SM)

3.3 Design. Unless otherwise specified herein, valves, valve parts, and design features and parameters shall conform to ANSI B16.34.

3.3.1 Pressure-temperature ratings. The design and pressure-temperature rating shall be in accordance with ANSI B16.34, except the maximum allowable temperature for composition D shall be 775°F. Pressure seal valves shall be designed in such a manner as to permit repair by the use of oversize seal rings. The detail design of the oversize seal ring shall be as shown on Drawing 803-3001021.

3.3.2 End connections. Valve end connections shall withstand the forces and moments imposed by the connecting pipe to which they are attached. For design purposes, the maximum value of the fiber stress in the connecting pipe produced by these forces and moments shall be considered to be equal to 8.2 percent offset yield stress of the piping material at room temperature.

3.3.3 End preparation. Design of welding ends and flange facing shall be as specified (see 6.2.1).

3.3.4 Drains and by-passes. Drains and by-passes shall be in accordance with the requirements specified in 3.3.4.1 through 3.3.4.3. A drain shall consist of a nipple and drain valve. A by-pass shall consist of connecting lines and a by-pass valve.

3.3.4.1 Size of drains and by-passes. Standard drain and by-pass sizes shall be as shown in table II. Nonstandard sizes shall be as specified (see 6.2.1).

TABLE II. Standard drain and by-pass sizes.

Valve size (inches)	Size of by-pass and drains (inches)
2-1/2	1/2
3	1/2
4	3/4
5	3/4
6	3/4
8	3/4
10	1
12	1
14	1-1/4
16	1-1/4

3.3.4.2 Location. The location of drains and by-passes shall be specified by referencing the letter designation of the desired bosses (see Figure 1 and 6.2.1). Bosses shall be sufficient distance away from seating area to allow welding of replacement by-pass line without damage to valve seat. When nonstandard locations are required, a drawing shall be furnished by the user indicating the desired location. When a location is not specified, the following standard locations shall be used:

- (a) By-pass - "A" to "B" of figure 1 (for globe and Y pattern valves), "E" to "F" of figure 1 (for angle valves).
- (b) Drain - "C" of figure 1 (for globe and Y pattern valves).